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Heredity and Environment in the Development of the Brain

By ROBERT E. KUTTNER and DONALD A. SWAN

INTRODUCTION

Behavior in both man and animals is subject to genetic control. Furthermore, behavior as much as structure has evolved over time. Differential selective pressures have brought about differences between and within species in sensory capacities and behavior. These differences can be studied on several levels. However, analysis of the mechanisms underlying behavior necessarily concerns a study of the central nervous system — and, in particular, the brain.

The development of the brain in man and in many animal populations includes a long postnatal period during which the emergence of order in the maturing central system depends upon the forces of development and upon the interaction between the forces of development and the effects of behavior and learning. The effects of experience, nutrition, and other environmental factors upon brain anatomy and brain chemistry have been the subject of considerable experimental work in recent years. Scientists active in this field have attempted to determine the extent to which neural processes are genetically " preprogrammed " or exhibit a developmental " plasticity " which may be modified by experience, learning, or nutritional deficits.

On the one hand, twin and family studies have been conducted to assess the genetic factors underlying mental ability, brain structure, and brain functioning. On the other hand, enriched-experience, early handling, and nutritional studies have been conducted on both animal and human populations to assess the environmental factors underlying brain development. It is the purpose of this paper to review and analyze this research.

PART I — GENETIC FACTORS

The functioning of the brain is studied on several levels. The neurophysiologist investigates the relation between psychic activity and variation in brain size and shape, electrical and chemical activity of the brain, conduction speed and excitation threshhold of the nerve fibers and nerve cells, *et al.* However, brain processes are externally manifested as human behavior. Over the

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past 100 years psychology has developed into a science of human behavior through the development of quantitative methods and techniques for the precise measurement of mental and psychical traits. Consequently, numerous studies have been made of individual differences in "physiological functions, motor capacities, sensory and perceptual sensitivity, intelligence, achievement and knowledge, interests, attitudes, and personality traits."[1]

The relationship between heredity and human behavior and intellectual functioning has been the subject of scientific interest for a long time. With the development of methods of quantitatively assessing the hereditary components in individual behavioral and intellectual differences, the science of behavioral genetics has become firmly established. Twin and family studies are the prime research tool of investigators in this field.

1. TWIN AND FAMILY STUDIES OF THE GENETICS OF INTELLIGENCE

Comparison of the differences between identical and fraternal twin pairs has provided some of the best evidence on the relationship between genotype and psychological phenotype. This is based on the assumption that the greater the difference in the degree of similarity between identical and fraternal twins respectively, the greater is the influence of heredity.[2]

Newman (1940) estimated the relative influence of hereditary and environmental factors on physical and psychical traits in a group of 50 identical and 50 fraternal twins. The percentage of variance due to heredity was found to range from 65 to 80 per cent in four measures of mental ability compared with a range of 75 to 90 per cent in six measures of physical traits. For the Otis Test series, Newman reported the percentage of variance due to heredity to be 77 per cent for the Otis Test Score and 80 per cent for the Otis Test I.Q.[3]

Burt (1958), in a review of English twin and family studies, found higher correlations in intelligence test performance for identical twins reared apart than for fraternal twins reared together and for siblings reared apart than for unrelated children reared together. With respect to the relative influence of heredity

[1] Leona Tyler, *The Psychology of Human Differences,* Appleton-Century-Crofts, New York, 1959, pp. 43-44.

[2] Henry E. Garrett, *Great Experiments in Psychology,* Appleton-Century-Crofts, New York, 1957, Chapters 11, 12 and 13; David C. Rife, *Heredity and Human Nature,* Vantage Press, New York, 1959.

[3] H. H. Newman, *Multiple Human Births,* Doubleday, Doran and Co., New York, 1940, p. 171.

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and environment, Burt concluded that of the total variance in intelligence test performance "only about 12 per cent (or slightly more) is apparently due to non-genetic influences and 88 per cent to genetic factors."[4]

Erlenmeyer-Kimling and Jarvik (1963) reviewed 52 studies conducted in eight countries on four continents over the past half century yielding over 30,000 correlational pairings for various genetic relationship categories. According to the authors, "considering only *ranges* of the observed measures, a marked trend is seen toward an increasing degree of intellectual resemblance in direct proportion to an increasing degree of genetic relationship, regardless of environmental communality." In addition, Erlenmeyer-Kimling and Jarvik noted that "for most relationship categories the *median* of the empirical correlations closely approaches the theoretical value predicted on the basis of genetic relationship alone."[5]

Vandenberg (1962) administered a battery of psychological tests totalling 117 separate scores to 45 identical and 37 fraternal twin pairs. The tests included Thurstone's Primary Mental Abilities Tests, a variety of other cognitive and achievement tests, motor skills measures, perceptual skills measures, sensory tests and measures of musical ability and interest, and personality tests. A statistically significant "degree of hereditary control" was found in 52 of the 117 test scores including some in each of the six groups. Heritability estimates ranging from .59 to .62 were found for the numerical, verbal, spatial and word fluency abilities in the Thurstone test series.[6]

Jensen (1970) reviewed and reanalyzed the intelligence test data from the four largest studies of monozygotic twins reared apart — Newman, 1937; Shields, 1962; Juel-Nielsen, 1965; Burt, 1955. The mean absolute difference between twins, for the total sample of 122 twin pairs, was found to be 6.60 I.Q. points with the largest difference being 24 I.Q. points. Jensen calculated the overall intraclass correlation between twins to be .824, which he interpreted as "an upper-bound estimate of the heritability (h^2) of I.Q. in the English, Danish, and North American Caucasian populations sampled in these studies." Jensen further compared the difference between monozygotic twins reared together with

[4] Sir Cyril Burt, "The Inheritance of Mental Ability," *The American Psychologist,* Vol. XIII, No. 1, 1958, pp. 1-15.

[5] L. Erlenmeyer-Kimling and L. Jarvik, "Genetics and Intelligence," *Science,* Vol. CXLII, 1963, pp. 1477-1479.

[6] Steven G. Vandenberg, "The Hereditary Abilities Study: Hereditary Components in a Psychological Test Battery," *American Journal of Human Genetics,* Vol. XIV, No. 2, 1962, pp. 220-237.

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the difference between monozygotic twins reared apart and concluded that " most of the small twin difference *in* I.Q. may be attributable to prenatal intrauterine factors rather than to later effects of the individual's social-psychological environment."[7]

2. TWIN AND FAMILY STUDIES OF THE GENETICS OF BRAIN STRUCTURE

The twin study method has also been used to investigate directly the heredity of brain structure. Ariens-Kappers (1929) reviewed some of the earlier twin and family studies of the morphology of the brain in his book *The Evolution of the Nervous System*.[8] Hereditary resemblances in the fissures and convolutional patterns of the brains of relatives of the same line, such as brothers and sisters, were found by Spitzka (1904),[9] Karplus (1905),[10] Waldeyer (1908),[11] and Shuster (1914).[12] According to Ariens-Kappers, Sano (1916; 1917),[13] who studied the brains of both twins and siblings, " controlled his results by comparisons with nonrelated brains and found a greater resemblance in relatives, amongst Europeans as well as amongst Negroes."[14]

Geyer (1940) studied the brain convolutions of twins and found that the differences in convolutional and fissural patterns of one-egg twins are scarcely larger than the differences in the two hemispheres of an arbitrary individual brain.[15]

[7] Arthur R. Jensen, " I.Q.s of Identical Twins Reared Apart," *Behavior Genetics,* Vol. I, No. 2, 1970, pp. 133-146.

[8] C. U. Ariens-Kappers, *The Evolution of the Nervous System in Invertebrates, Vertebrates, and Man,* De Erven F. Bohn, Haarlem, Holland, 1929, pp. 300-301.

[9] E. A. Spitzka, " Hereditary Resemblance in the Brains of Three Brothers," *American Anthropologist,* Vol. 6, 1904.

[10] J. B. Karplus, " Über Familienähnlichkeiten an den Grosshirnfurchen des Menschen," *Arbeiten a.d. neurologischen Institut der Universität Wien,* Vol. 12, 1905.

[11] A. Waldeyer, " Gehirne von Zwillingfruchten Geschlechter," *Zeitschrift für Ethnologie,* Vol. 40, 1908.

[12] A. Shuster, " Hereditary Resemblance in the Fissures of the Cerebral Hemisphere," *Mott's Archives of Neurology,* Vol. 6, 1914.

[13] R. Sano, " The Convolutional Pattern of the Brains of Identical Twins: A Study on Hereditary Resemblance of Furrows of the Cerebral Hemispheres," *Philosophical Transactions of the Royal Society of London: Series B,* Vol. 208, 1916; R. Sano, " Convolutional Pattern of Relative Brains in Man," *Proceedings of the Royal Society of Medicine,* Vol. X, 1917.

[14] C. U. Ariens-Kappers, *op. cit.,* p. 300.

[15] H. Geyer, " Über Hirnwindungen bei Zwillingen," *Zeitschrift für Morphologie und Anthropologie,* Vol. 38, 1940, pp. 51-55.

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However, these early studies on the heredity of brain structure are basically subjective and impressionistic in their methodology. The results should be accepted with caution unless confirmed by investigations employing more objective techniques. Research into the genetics of the electrical activity of the brain affords the most promising approach to the study of the extent to which hereditary factors govern the functioning of the brain.

3. TWIN AND FAMILY STUDIES OF THE GENETICS OF BRAIN FUNCTIONING

In 1929 the German psychiatrist, Hans Berger, " made the first recordings of the electrical activity of the human brain." Since that time the technique has been applied by physiological research workers and " by physicians and psychologists in their investigations of normal and pathological brain function."[16] Brumlik, Richeson, and Arbit (1966) recently reviewed the major theories which have been proposed to "explain the origin of brain rhythms." They classified these theories into three main groups: " those proposing a neural origin, those suggesting a mechanical cause, and combined theories." The neuronal theories " propose that the so-called α-rhythm of the brain arises from potentials generated within the neurones or astroglia of the brain." Included in this group of theories are those that stress " summation of dendritic potentials," axonal and reverberating-circuit theories. The mechanical theories are based on " cardiac, respiratory, or ballistocardigraphic mechanisms."[17]

Other investigators have attempted to correlate electrophysiological data with the changes of morphological features. Purpura, Carmichael, and Housepian (1960) studied kittens in the fetal stage up to an age of six weeks postnatally. The superficial cortical response, for example, " correlated with the maturation of basilar dendrites."[18] Noback and Purpura (1961) found that in the first three postnatal weeks " the dendrites of the cortical neurons increased in length and caliber, and possessed

[16] J. W. Osselton, " Introduction to Electroencephalography," *Readings in General Psychology* (edited by P. Halmos and A. Iliffe), Philosophical Library, New York, 1959, pp. 15-32.

[17] Joel Brumlik, William B. Richeson and Jack Arbit, " The Origin of Certain Electrical Cerebral Rhythms," *Brain Research*, Vol. 3, 1966-1967, pp. 227-247.

[18] D. P. Purpura, M. W. Carmichael and E. M. Housepian, " Physiological and Anatomical Studies of Development of Superficial Axodendritic Synaptic Pathways in Neocortex," *Experimental Neurology*, Vol. 2, 1960, pp. 324-347.

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greater degrees of branching and dendritic spines."[19] Schadé and Baxter (1960) studied volume and surface area changes of cortical neurons in the rabbit. Similar changes were noted for basilar dendrites, except that the changes were even greater. These "morphological changes paralleled the development of surface electrical activity."[20]

Berger (1933) was also the first worker to study the psychological correlates of the EEG, reporting a relationship between EEG indices and the intelligence in mental defectives.[21] Since that time numerous studies have been conducted on the relationship of EEG to intelligence test scores. Vogel and Broverman (1964) reviewed the extensive literature in this subject and noted that "evidence for the relationship between these two variables seems strongest for samples of children, institutionalized geriatric patients, mental deficients, and brain-injured persons; and weakest for samples of normal adults."[22] Although Mundy-Castle (1958)[23] and Mundy-Castle and Nelson (1960)[24] found significant relationships between test intelligence and EEG tracings in samples of normal adults, most investigators have not found such relationships.

Consequently, recent investigations of the electrophysiological correlates have concentrated upon the relation between cortical potentials evoked by stimuli and intelligence test performance. Other researchers are collecting the EEG data while the subject is engaged in mental task. Barry and Ertl (1963) made the first investigation of the relation between evoked potential and psychometric measures of intelligence. They reported a correlation of –0.88 between Wechsler-Bellevue I.Q. and the latency of the first discernible change in the evoked potential following photic stimulation in a sample of 11 post-graduate students whose I.Q.'s

[19] C. Noback and D. P. Purpura, "Postnatal Ontogenesis of Neurons in Cat Neocortex," *Journal of Comparative Neurology,* Vol. 117, 1961, pp. 291-307.

[20] J. P. Schadé and C. F. Baxter, "Changes During Growth in the Volume and Surface Area of Cortical Neurons in the Rabbit," *Experimental Neurology,* Vol. 2, 1960, pp. 158-178.

[21] H. Berger. "Über das Electroenkephalogram des Menschen," *Arch. Psychiat, Nerve kr.,* Vol. 98, 1933, pp. 231-254.

[22] William Vogel and Donald M. Broverman, "Relationship Between EEG and Test Intelligence: A Critical Review," *Psychological Bulletin,* Vol. 62, No. 2, 1964, pp. 132-144.

[23] A. C. Mundy-Castle, "Electrophysiological Correlates of Intelligence," *Journal of Personality,* Vol. 26, 1958, pp. 184-199.

[24] A. C. Mundy-Castle and G. K. Nelson, "Intelligence, Personality, and Brain Rhythms in a Socially Isolated Community," *Nature,* Vol. 185, 1960, pp. 484-485.

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ranged from 106 to 139. The authors concluded that the shorter cortical delay seen in the higher I.Q. subjects was evidence for greater "neural efficiency."[25]

Subsequently, Ertl (1968) reported data from a major study involving the administration of three different intelligence tests to a random sample of 300 Canadian school children. Event three of the AEP was significantly correlated with the Otis I.Q. ($r = -0.51$), with the Primary Mental Abilities total score ($r = -0.41$), and with the WISC I.Q. ($r = -0.33$).[26]

Osborne (1969) investigated the relation between the average time periods of the theta, alpha, and beta components of the AEP and the subtest or total scores of the Revised Beta Examination, which is a non-verbal test of mental ability. He found the period of the beta waves to be inversely related to four subtests and the total score, with r's ranging from –0.30 to –0.39 (significant at $p<.05$). The alpha period was positively correlated with the total test score ($r = 0.28$).[27]

Twin and family studies have also been applied to investigate the genetic basis of electrical activity in the brain. Lennox, Gibbs and Gibbs (1945) investigated the similarity of brain-wave pattern in a sample of 74 normal twin pairs. Among the 55 monozygotic twins EEG tracings were "judged to be identical in 85 per cent." The authors concluded that "the brain wave pattern is an hereditary trait" and that the EEG "can be used in human genetic studies."[28]

Vogel (1958) examined 208 twin pairs of the same sex, including 110 monozygotic twins, in the resting stage, with hyperventiliation, oxygen lack, and during sleep. He found amazingly good agreement in EEG traits among monozygotic twins and concluded that "the variability of the EEG under normal conditions is exclusively determined by heredity."[29]

Juel-Nielsen and Harvald (1958) examined eight pairs of Danish monozygotic twins between 22 and 72 years of age who had grown up apart from early childhood. "Practically complete concordance as regards both normal qualities and abnormalities"

[25] W. Barry and J. Ertl, "Intra-Cortical Delay and Intelligence," *Revue de l'Universite d'Ottawa,* Vol. 33, 1963, pp. 197-202.

[26] J. Ertl, "Evoked Potentials, Neural Efficiency, and I.Q.," *International Symposium for Biocybernetics,* Washington D.C., 1968.

[27] R. Travis Osborne, "Psychometric Correlates of the Visual Evoked Response," *Acta Psychologica,* Vol. 29, 1969, pp. 303-308.

[28] W. G. Lennox, E. L. Gibbs and F. A. Gibbs, "The Brainwave Pattern: An Hereditary Trait," *The Journal of Heredity,* Vol. 36, 1945, pp. 233-244.

[29] Friedrich Vogel, *Über die Erblichkeit des normalen Elektroencephalogramms,* Thieme, Stuttgart, Germany, 1958.

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was found by the authors, who concluded that "the individual EEG pattern is primarily determined by hereditary factors."[30]

Osborne (1970) investigated the heritability of the visual evoked response in a sample of 13 pairs of monozygotic and six pairs of dizygotic twins. According to the author, "the hereditary nature of the visual evoked response is shown by the high degree of similarity of response pattern for identical twins and by the predictable decrease in similarity for fraternal twins and for unrelated control subjects."[31]

Vogel (1970) recently summarized and reviewed the literature on the genetic basis of the normal human EEG. He concluded that "the twin data demonstrates complete genetic determination of the EEG, including the maturation during childhood, the mature EEG during adult life, and also the 'normal' continuous involution in high age." Vogel also analyzed the family data on "variants of the alpha rhythm" and "the EEG with ß-waves," with a view to determining the mode of inheritance of the EEG. He concluded that the normal alpha pattern and most of the recordings with beta waves have "a multifactorial genetic basis."[32]

In summary, insights into the extent to which heredity plays a rôle in the functioning of the brain have been gained from research in the field of electrophysiology. The development of the surface electrical activity of the brain has been shown to be correlated with neural morphological changes, such as the maturation of basilar dendrites, in a variety of animal populations. Psychical correlates of the EEG have been found in samples of children, institutionalized geriatric patients, mental deficients, and brain-injured persons. Recent investigations have established statistically significant correlations between cortical potentials evoked by stimuli and psychometric measures of intelligence in samples of school children and normal adults. Twin studies have further demonstrated that "the variability of the EEG under normal conditions is exclusively determined by heredity."

PART II — ENVIRONMENTAL FACTORS

The effects of environmental factors on the development of the brain have been studied by numerous investigators. Two main

[30] Juel-Nielsen and B. Harvald, "The Electroencephalogram in Uniovular Twins Brought Up Apart," *Acta Genetica,* Vol. 8, 1958, pp. 57-64.

[31] R. Travis Osborne, "Heritability Estimates for the Visual Evoked Response," *Life Sciences,* Vol. 9, 1970, pp. 481-490.

[32] Friedrich Vogel, "The Genetic Basis of the Normal Human Electroencephalogram (EEG)," *Humangenetik,* Vol. 10, 1970, pp. 91-114.

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avenues of intensive effort can be discerned. In the first, the external environment is modified. It is either "enriched" by stimulus-producing objects or the animals are exposed to taming procedures (handling). Conversely, the animals may be "isolated" by solitary caging or by surgical enucleation to produce sensory deprivation. The second approach is to modify the internal environment by diets, hormones and other means. Attempts have been made to extend the results obtained with animals to humans as a guide to the consequences of pathological neglect or extreme malnutrition.

Attention has focused on fetal, newborn and young animals. The rationalization for this emphasis derives from the fact that the complement of neuronal cells in the higher mammals does not significantly alter after maturation is complete. Since adult (non-senile) animals and men are not known to show irreversible changes in brain behavior following prolonged stimulus, stress (non-psychogenic) or during recovery from starvation, any permanent effects must be produced while central nervous tissue is in a vulnerable proliferative or growth phase.

1. ENRICHED-EXPERIENCE RESEARCH

The pioneer studies of an interdisciplinary team on chemical and anatomical changes in rodent brains were reviewed to the year 1964 in a classic paper by Bennett, *et al.*[33] Weaned rats raised in environmentally "complex" cages containing "toys" that induced a form of self-training were found to have heavier cortices than litter mates kept isolated or under standard conditions. Non-cortical weights were slightly less. The environmentally stimulated animals showed the greatest increments in cortical thickness and weight in the visual areas (about 6 per cent). The activity of acetylcholinesterase, a key enzyme in nerve transmission, was elevated about 3 per cent in the cortices of the same animals. Rather surprisingly, similar changes were found for adult rats exposed to the same stimulating conditions.

Although the changes reported were small, they were replicated many times and are statistically valid. Subsequent work served to extend and confirm the thesis of the authors that the brain is chemically and anatomically "plastic" and capable of response to external manipulation. The authors also refer to a selective breeding experiment which achieved much larger differences between two stocks in cortical weight and acetylcholinesterase

[33] E. L. Bennett, M. C. Diamond, D. Krech and M. R. Rosenzweig, "Chemical and Anatomical Plasticity of Brain," *Science*, Vol. 146, 1964, pp. 610-619.

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activity (ranging over 25 per cent) which suggests that genetic factors can be four or more times as important in producing changes of this nature.

Parallel modifications have been observed in mice and gerbils after differential rearing.[34] Furthermore, since most experiments were carried out with closely inbred laboratory strains that lack genetic variability, it may be suspected that heterogenous "wild" strains would show magnified responses in cerebral morphology or chemistry to environmental treatment.[35] Not all workers concur on these matters. Denenberg and his colleagues (1969) did not see brain weight differences in weaned mice raised under isolated and enriched conditions.[36] Collins (1970) failed to find superior discrimination task performance in enriched mice relative to isolated controls.[37] The brain weights in her mice groups were not significantly different. In fact, the isolated group showed a slight trend towards heavier cortices and total brain weights.

The physiological mechanism responsible for brain differences in isolated and stimulated rats has not been discovered. Geller, Yuwiler, and Zolman (1965) suggested that isolation may be sufficiently abnormal to trigger the endocrine system in the same manner as chronic stress.[38] In their animals, liver enzymes known to be influenced by stress were found altered after isolation caging in a direction compatible with pituitary-adrenal activation. Corticosterones are known profoundly to interfere with chemical processes in the growing brain.[39]

It was left to Rosenzweig, Krech, Bennett and Diamond, the investigators who first demonstrated brain "plasticity" by environmental agents, to open the question as to whether their

[34] Mark R. Rosenzweig and Edward L. Bennett, "Effects of Differential Environments on Brain Weights and Enzyme Activities in Gerbils, Rats and Mice," *Developmental Psychobiology,* Vol. 2, 1969, pp. 87-95.

[35] Norman D. Henderson, "Brain Weight Increases Resulting from Environmental Enrichment: A Directional Dominance in Mice," *Science,* Vol. 169, 1970, pp. 776-778.

[36] Victor H. Denenberg, Francine Wehmer, Jack Werboff and M. X. Zarrow, "Effects of Post-Weaning Enrichment and Isolation Upon Emotionality and Brain Weight in the Mouse," *Physiology and Behavior,* Vol. 4, 1969, pp. 403-406.

[37] Ruth-Ann Collins, "Experimental Modification of Brain Weight and Behavior in Mice: An Enrichment Study," *Developmental Psychobiology,* Vol. 3, 1970, pp. 145-155.

[38] Edward Geller, Arthur Yuwiler and James F. Zolman, "Effects of Environmental Complexity on Constituents of Brain and Liver," *Journal of Neurochemistry,* Vol. 12, 1965, pp. 949-955.

[39] Evelyn Howard, "Reductions in Size and Total DNA of Cerebrum and Cerebellum in Adult Mice after Corticosterone Treatment in Infancy," *Experimental Neurology,* Vol. 22, 1968, pp. 191-208.

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work had pertinence for man.[40] The temptation to extrapolate from rodent to human is great. But the evidence will not support a connection across this species gap. Rosenzweig and colleagues themselves have done the critical experiment that undermines the attempt to extend their work to humans. They report that a mere two-hour exposure to enriched environments produces cerebral weight and enzyme increments equal to a full 24-hours' treatment.[41] This minimal stimulus can hardly be avoided in a human family. If " isolation " can modify a juvenile human brain, the degree needed to approach the rat analogy would come so close to total neglect as to be incompatible with survival. This conclusion is in harmony with those expressed by Sperry (1968) in an important review.[42] He states:

> As for any attempt to relate these findings in rodents to primates, especially to man, one can only say that such incomplete evidence as is available has failed, as yet, to show that enrichment of experience in infancy and early childhood beyond average care and maintenance will increase cortical dimensions or even intellectual potential.

2. EARLY HANDLING RESEARCH

Behavioral qualities can be transformed in infant animals by " early handling " protocols. This phenomenon superficially resembles environmental enrichment except that the interacting factor is the investigator rather than a collection of inert stimulus objects. The procedures employed are akin to " gentling," " petting," or " taming " and have been known to animal trainers since prehistory. Changes in brain anatomy or chemistry have not been established. The most singular modifications are in the area of emotionality. Young animals, for the most part rat pups, exhibit reduced timidity and anxiety after only a few minutes of daily physical contact with the experimenter. Visual cues can be eliminated since " gentling " can be accomplished while eyes are

[40] Mark R. Rosenzweig, " Environmental Complexity, Cerebral Change and Behavior," *American Psychologist,* Vol. 21, 1966, pp. 321-332; David Krech, " Behavior, Brain and Biochemistry," American Association for the Advancement of Science, Symposium, December 27-28, 1965. Reports of Sections and Societies. *Science,* Vol. 151, 1966, pp. 858-859.

[41] Mark R. Rosenzweig, William Love and Edward L. Bennett, " Effects of a Few Hours a Day of Enriched Experience on Brain Chemistry and Brain Weights," *Physiology and Behavior,* Vol. 3, 1968, pp. 819-825.

[42] R. W. Sperry, " Plasticity of Neural Maturation," *Developmental Biology Supplement,* Vol. 2, 1968, pp. 306-327.

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still sealed. An endocrine basis for these effects seems likely in view of the fact that infant behavior can be modified before birth by the handling of the pregnant mothers.[43]

Many studies have been conducted to explicate the consequences of early handling. A convincing series of experiments have suggested that separation of rat pups from their mothers causes a fall in body temperature which engenders endocrine-mediated behavioral effects.[44] Denenberg (1967) was able to show that warming pups removed from their nests could suppress the elevated adrenal and plasma corticosterone response that follows "handling" (separation or temperature) stress.[45] Interrupted feeding and subtle tactile or olfactory stimuli may also play a rôle in separation-induced, long-lasting, psychological adjustments.[46]

Higher mammals are not immune to the effects of "isolation" or "handling." Interesting data have been collected on young dogs. It has been the subject of speculation that isolation prevents habituation to common stimulus objects so that a dog newly exposed to a standard environment cannot distinguish relevant from irrelevant perceptions. A flood of novel stimuli overloads the naive animal's sensory filters so that a fear or freeze reaction may ensue. Tranquilizing drugs may prevent the symptoms of

[43] Robert Ader and Peter M. Conklin, "Handling of Pregnant Rats: Effects on Emotionality of Their Offspring," *Science,* Vol. 142, 1963, pp. 411-412; Jack Werboff, Albert Anderson and Burton N. Haggett, "Handling of Pregnant Mice: Gestational and Postnatal Behavioral Effects," *Physiology and Behavior,* Vol. 3, 1968, pp. 35-39.

[44] Howard F. Hunt and Leon S. Otis, "Early Experience and its Effects on Later Behavioral Processes in Rats: I. Initial Experiments," *Transactions of the New York Academy of Sciences,* Vol. 25, 1963, pp. 858-870; Theodore Schaefer, Jr., "A Critical Factor in the Early Handling Phenomenon: II," *Transactions of the New York Academy of Sciences,* Vol. 25, 1963, pp. 871-889; Donald E. Hutchings, "Effects of Infantile Handling and Body Temperature Reduction on Later Emotionality: III," *Transactions of the New York Academy of Sciences,* Vol. 25, 1963, pp. 890-901; Theodore Schaefer, Jr., "Infantile Handling and Body Temperature Change in the Rat: I. Initial Investigations of the Temperature Hypothesis," *Transactions of the New York Academy of Sciences,* Vol. 30, 1968, pp. 977-984; Donald E. Hutchings, "Parametric Investigations of Body Temperature Loss and Theoretical Implications: II," *Transactions of the New York Academy of Sciences,* Vol. 30, 1968, pp. 985-991; Anstiss H. McIver, Wendell E. Jeffrey, Michael Stevenson and Harold C. Nielson, "Early Temperature Change and Its Implications for Later Responses: III," *Transactions of the New York Academy of Sciences,* Vol. 30, 1968, pp. 992-1000.

[45] Victor H. Denenberg, Joan T. Brumaghim, Gary C. Haltmeyer and M. X. Zarrow, "Increased Adrenocortical Activity in the Neonatal Rat Following Handling," *Endocrinology,* Vol. 81, 1967, pp. 1047-1052.

[46] Myron A. Hofer, "Physiological Responses of Infant Rats to Separation from Their Mothers," *Science,* Vol. 168, 1970, pp. 871-873.

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post-isolation emergence reaction. Beagles tend to withdraw or show depressive responses, while terriers reveal the hyperactivity characteristic of their breed.[47]

The attempt to account for differences in brain or behavior between human classes and races in terms of environmental influences uncovered in animal work is exceptionally hazardous. All cultures and societies provide a wide spectrum of stimuli. Underprivileged ghetto children are not denied sensory inputs although the myriad sounds and sights of urban life may not be aesthetically pleasing to academic psychologists. Among primates, interaction with the mother is of paramount importance and separation can devastate the personality of a young monkey (e.g. Harlow).[48] Yet every human culture provides a family or a surrogate parent; otherwise survival would be jeopardized. The extreme social deprivation that may occur with sociopathic parents is of such rarity that whatever damage it may afflict could not alter group norms. Early-handling deficits can be ruled out for primitive peoples inhabiting underdeveloped areas. It is commonly observed that family interaction is more intense and spontaneous in less advanced cultures.[49] The conclusion can be ventured that brain morphology and mental traits are more governed by genetic factors than by the types of environmental manipulation tested on animals in laboratories.

3. NUTRITIONAL RESEARCH — ANIMAL STUDIES

The internal environment of the developing organism is influenced by nutrition. A faulty diet can temporarily disorganize mental functions in adults. Proper feeding restores normal function. With immature organisms, however, lengthy malnutrition can delay central nervous system development and directly reduce intelligence and learning potential. These effects can also be indirectly exerted. A severe protein deficiency can prevent the synthesis of regulatory peptide hormones that are vital for pregnancy, growth and cell metabolism.[50] Another byproduct is

[47] John L. Fuller, "Experimental Deprivation and Later Behavior," *Science,* Vol. 158, 1967, pp. 1645-1652.

[48] H. F. Harlow, M. K. Harlow and S. J. Suomi, "From Thought to Therapy: Lessons from a Primate Laboratory," *American Scientist,* Vol. 59, 1971, pp. 538-549.

[49] Marcelle Geber, "The Psycho-motor Development of African Children in the First Year, and the Influence of Maternal Behavior," *Journal of Social Psychology,* Vol. 47, 1958, pp. 185-195.

[50] James H. Leathem, "Nutritional Effects on Hormone Production," *Journal of Animal Science* (*supplement*), Vol. 25, 1966, pp. 68-82; B. N. Berg, E. B. Sigg and P. Greengard, "Maintenance of Pregnancy in Protein-deficient Rats by Adrenocortical Steroid or ACTH Administration," *Endocrinology,* Vol. 80, 1967, pp. 829-834.

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increased vulnerability to debilitating diseases that may further damage young organisms.[51]

The importance of maternal and postnatal nutrition for optimum health is universally recognized. The reciprocal contention that malnutrition can irreversibly injure the brain is less well supported. Data cited for physical and psychological damage in typical recent reviews have tended to emphasize results obtained from extreme deprivation studies.[52] The topic is worth re-examining for both animal and human subjects.

When protein or protein calories are drastically reduced during pregnancy or lactation or both, rat offsprings show decreased brain weights, fewer cells, and lower brain nucleic acid and protein levels on comparison with control animals.[53] Chow (1968) has shown that the somatic runting accompanying such diets persists into adulthood despite re-alimentation.[54] A similar finding has been made for mice initially reared on a diet lacking an essential amino acid or mineral.[55]

Rats born to mothers underfed during gestation and nursing made more errors in maze learning than controls even after two months of nutritional rehabilitation.[56] Emotionality was heightened

[51] Nevin S. Scrimshaw, "The Effect of the Interaction of Nutrition and Infection on the Pre-school Child," *Pre-school Child Malnutrition: Primary Deterrent to Human Progress,* National Academy of Sciences Publication Offices, Washington D.C., 1966, pp. 63-73.

[52] Phillip V. Tobias, "Brain Size, Grey Matter and Race — Fact or Fiction?" *American Journal of Physical Anthropology,* Vol. 32, 1970, pp. 3-25; Herbert G. Birch and Joan D. Gussow, *Disadvantaged Children: Health, Nutrition, and School Failure,* Grune and Stratton, Inc., New York, 1970.

[53] S. Zamenhof, E. Marthens and F. L. Margolis, "DNA (Cell Number) and Protein in Neonatal Brain: Alteration by Maternal Dietary Protein Restriction," *Science,* Vol. 160, 1968, pp. 322-323; Helen A. Guthrie and Myrtle L. Brown, "Effect of Severe Undernutrition in Early Life on Growth, Brain Size and Composition in Adult Rats," *Journal of Nutrition,* Vol. 94, 1968, pp. 419-426; M. Brown and H. A. Guthrie, "Effect of Severe Undernutrition in Early Life Upon Body and Organ Weights in Adult Rats," *Growth,* Vol. 32, 1968, pp. 143-150; William J. Culley and Robert O. Lineberger, "Effect of Undernutrition on the Size and Composition of the Rat Brain," *Journal of Nutrition,* Vol. 96, 1968, pp. 375- 381.

[54] Bacon F. Chow, Quentin R. Blackwell and Roger W. Sherwin, "Nutrition and Development," *Borden's Review of Nutrition Research,* Vol. 29, 1968, pp. 25-39.

[55] Rene Dubos, Russell W. Schaeder and Richard Costello, "Lasting Biological Effects of Early Environmental Influences: I. Conditioning of Adult Size by Prenatal and Postnatal Nutrition," *Journal of Experimental Medicine,* Vol. 127, 1968, pp. 783-799.

[56] M. Simonson and B. F. Chow, "Maze Studies on Progeny of Underfed Mother Rats," *Journal of Nutrition,* Vol. 100, 1970, pp. 685-690.

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but exploratory behavior was decreased. Protein restriction for just the second half of gestation was sufficient to lower maze learning capacity.[57] Prenatal undernutrition by itself could enhance emotionality and suppress activity even after nursing by adequately fed foster-mothers.[58] Other reports indicate that exploratory drive and spontaneous activity are reduced when rat pups are reared by protein-restricted dams despite *ad libitum* feeding after weaning.[59]

Not all reports are consistent. Guthrie (1968) found no difference in avoidance learning, emotionality, or exploratory behavior in adult albino rats undernourished in the preweaning period.[60] Her animals also showed increased activity. One paper reported behavioral abnormalities resulting from under-lactation but no learning deficits.[61] It has been suggested that some of the behavioral changes following restricted feeding may be caused by an altered response to food rewards used as a matter of routine in testing rodent performance.[62]

Other uncertainties enter the interpretation of these studies. The earliest and largest decrements in brain DNA concentration (a nucleic acid proportional to cell number) in malnourished newborn rat pups occur in the cerebellum, a region less crucial for learning tasks than the cerebrum.[63] Nor do all species show such changes of composition as a consequence of protein deprivation. Barnes (1969) has noted that progeny of gilts fed a protein-

[57] Donald F. Caldwell and John A. Churchill, "Learning Ability in the Progeny of Rats Administered a Protein-Deficient Diet During the Second Half of Gestation," *Neurology,* Vol. 17, 1967, pp. 95-99.

[58] M. Simonson, J. K. Stephan, H. M. Hanson and B. F. Chow, "Open Field Studies in Offspring of Underfed Mother Rats," *Journal of Nutrition,* Vol. 101, 1971, pp. 331-336.

[59] Slavka Frankova and Richard H. Barnes, "Influence of Malnutrition in Early Life on Exploratory Behavior of Rats," *Journal of Nutrition,* Vol. 96, 1968, pp. 477-484.

[60] Helen A. Guthrie, "Severe Undernutrition in Early Infancy and Behavior in Rehabilitated Albino Rats," *Physiology and Behavior,* Vol. 3, 1968, pp. 619-623.

[61] Slavka Frankova and Richard H. Barnes, "Effect of Malnutrition in Early Life on Avoidance Conditioning and Behavior of Adult Rats," *Journal of Nutrition,* Vol. 96, 1968, pp. 485-493.

[62] R. H. Barnes, C. S. Neely, E. Kwong, B. A. Labadan and S. Frankova, "Postnatal Nutritional Deprivation as Determinants of Adult Rat Behavior Toward Food, its Consumption and Utilization," *Journal of Nutrition,* Vol. 96, 1968, pp. 467-476.

[63] Irving Fish and Myron Winick, "Effect of Malnutrition on Regional Growth of the Developing Rat Brain," *Experimental Neurology,* Vol. 25, 1969, pp. 534-540.

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free diet during gestation had normal cerebral and cerebellar levels of protein and nucleic acid.[64]

A broad search for the mechanism behind nutritional injury to the developing central nervous system was unsuccessful. Severe protein deficiency during the last trimester of rat gestation did not have significant quantitative or qualitative effects on the pattern of uterine-free amino acids.[65] Kuttner (1970) and colleagues also investigated blood-brain barrier function in nutritionally runted infant rats in the hope of locating a "lesion" above the cellular level of complexity.[66] The uptake and transport of a radioactive model amino acid fell within normal rates. A promising line of work has attempted to connect undernutrition with decreases in the concentration of neurohormones belonging to the catecholamine family.[67]

Regardless of the outcome of animal studies, it is safe to conclude that extrapolation to humans is presently unwarranted. A newborn infant weighs 5 or 6 per cent of its mother's normal body weight. A litter of eight rat pups can exceed 20 per cent of the body mass of a non-pregnant female rat. It follows that a pregnant rodent is far more vulnerable to protein deficiencies since it must form proportionately three or four times more fetal tissue than a human. Lactation can likewise be more traumatic to the rat. A human infant nursed for a year would scarcely reach 20 per cent of the mother's weight. A rat litter, on the other hand, may be weaned when its total weight is nearly equal to that of the mother. Food restriction imposes a much greater nutritional stress on pregnant and lactating rodents, making these species poor choices for human comparisons.

4. NUTRITIONAL RESEARCH — HUMAN STUDIES

Of necessity, research on human undernutrition is more observational than experimental. Pregnant women, infants, and

[64] W. G. Pond, D. N. Strachan, Y. N. Sinha, E. F. Walker, Jr., J. A. Dunn and R. H. Barnes, "Effect of Protein Deprivation of Swine During All or Part of Gestation on Birth Weight, Postnatal Growth Rate and Nucleic Acid Content of Brain and Muscle of Progeny," *Journal of Nutrition*, Vol. 99, 1969, pp. 61-67.

[65] Albert B. Lorincz and Robert E. Kuttner, "Free Amino Acids in the Pregnant Uterus," *American Journal of Obstetrics and Gynecology*, Vol. 105, 1969, pp. 925-932.

[66] Alan B. Weder, Albert B. Lorincz and Robert E. Kuttner, "Amino Acid Transport in Progeny of Undernourished Pregnant Rats," *Proceedings, Illinois Academy of Sciences (Abstract)*, 63rd Annual Meeting, 1970, pp. 2-3.

[67] William J. Shoemaker and Richard J. Wurtman, "Perinatal Undernutrition: Accumulation of Catecholamines in Rat Brain," *Science*, Vol. 171, 1971, pp. 1017-1019.

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juveniles must be located in war-devastated zones or in economically blighted areas. Special customs such as postponed weaning in Africa can cause infantile malnutrition (Kwashiorkor), an entity drawing much medical attention. Simple starvation (marasmus) is ordinarily rare in advanced technical civilizations and must be diligently hunted for in backward parts of the world.

Winick (1969) sampled the brains of infants who died of malnutrition. Head circumference, brain weights, and protein and nucleic acid levels were reduced in his nine marasmic Chilean infants.[68] An enlarged group including some Jamaican infants showed similar trends.[69] This last study revealed that cell multiplication in both cerebrum and cerebellum were equally curtailed, a finding not anticipated from previous rat work. Chemical analyses of white matter from the brains of four starved and diseased Puerto Rican infants revealed small decreases in certain lipid components associated with the myelin sheaths of neurons.[70] Furthermore, pregnant rats on a fat-free diet produce young with maze learning deficits.[71] It is also known that weaned rats from large litters have lower brain lipid substances than amply nursed pups from litters of two.[72]

Interesting data have been obtained from recovered Kwashiorkor victims. Nineteen successfully treated Hindu children were matched some years later with suitable controls and given mental tests adapted for use with non-literate populations.[73] Performance was 30 to 50 per cent of control scores with the gap closing slightly with increased age. This is the largest decline reported for children who have suffered an episode of severe malnutrition.

[68] Myron Winick and Pedro Rosso, "Head Circumference and Cellular Growth of the Brain in Normal and Marasmic Children," *Journal of Pediatrics,* Vol. 74, 1969, pp. 774-778; Myron Winick and Pedro Rosso, "The Effect of Severe Early Malnutrition on Cellular Growth of Human Brain," *Pediatric Research,* Vol. 3, 1969, pp. 181-184.

[69] Myron Winick, Pedro Rosso and John Waterlow, "Cellular Growth of Cerebrum, Cerebellum, and Brain Stem in Normal and Marasmic Children," *Experimental Neurology,* Vol. 26, 1970, pp. 393-400.

[70] Marvin A. Fishman, Arthur L. Prensky and Philip R. Dodge, "Low Content of Cerebral Lipids in Infants Suffering from Malnutrition," *Nature,* Vol. 221, 1969, pp. 552-553.

[71] Donald F. Caldwell and John A. Churchill, "Learning Impairment in Rats Administered a Lipid-free Diet During Pregnancy," *Psychological Reports,* Vol. 19, 1966, pp. 99-102.

[72] R. L. Geison and Harry A. Waisman, "Effects of Nutritional Status on Rat Brain Maturation as Measured by Lipid Composition," *Journal of Nutrition,* Vol. 100, 1970, pp. 315-324.

[73] S. Champakam, S. G. Srikantia and C. Gopalan, "Kwashiorkor and Mental Development," *American Journal of Clinical Nutrition,* Vol. 21, 1968, pp. 844-852.

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Genetic factors cannot be eliminated since performance data on the parents were not obtained. The authors themselves suggest that parents in a poor community who can protect their offsprings from starvation would rank higher on motivation, intelligence, and resourcefulness than the parents of the victims. Head measurements did not distinguish the children.

A study on growth-retarded Australian Aboriginal students with multiple diet deficiencies and parasitic infestations revealed that primary school grades were lower than for controls with histories of normal growth.[74] By Caucasian standards, head circumferences clustered at the lower end of the distribution curve.[75] Unfortunately, without a large group of well-tended Aboriginal children for comparison purposes, it is difficult to determine to what degree these differences are due to race.

Stoch and Smythe (1963) carried out a longitudinal survey on South African Cape children divided into a "normal" and an undernourished group. Both groups were drawn from socio-economically deprived families. But the "normals" received nursery care and vitamin supplements. These had larger head circumferences and better scores on various tests revised for African natives.[76] Intervening factors such as better housing, superior maternal care, and the absence of the stigma of illegitimacy can be invoked for the "normal" sample.

Brockman and Ricciuti (1971) reported on marasmic children in Lima, Peru, who on hospital admission were 50 per cent under their expected weights.[77] These subjects lagged strikingly behind control age mates on cognitive tasks and showed virtually no improvement even after 12 weeks of nutritional treatment. For this extreme undernutrition, the follow-up period may have been too short.

From a review of the literature, Cravioto (1966) cites evidence that short-term, early childhood starvation does not permanently

[74] David G. Jose and John S. Welch, "Growth Retardation, Anaemia and Infection, With Malabsorption and Infestation of the Bowel: The Syndrome of Protein-Calorie Malnutrition in Australian Aboriginal Children," *Medical Journal of Australia,* Vol. 1, 1970, pp. 349-356.

[75] G. M. Maxwell and R. B. Elliott, "Nutritional State of Australian Aboriginal Children," *American Journal of Clinical Nutrition,* Vol. 22, 1969, pp. 716-724.

[76] M. B. Stoch and P. M. Smythe, "Does Undernutrition During Infancy Inhibit Brain Growth and Subsequent Intellectual Development?" *Archives of Diseases of Childhood,* Vol. 38, 1963, pp. 546-552.

[77] Lois M. Brockman and Henry N. Ricciuti, "Severe Protein Calorie Malnutrition and Cognitive Development in Infancy and Early Childhood," *Developmental Psychology,* Vol. 4, 1971, pp. 312-319.

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depress developmental quotients.[78] This is in keeping with the observations of Winick (1968) on cellular recovery in rats following brief neonatal undernutrition.[79] In a subsequent paper, Cravioto (1970) again affirms that good progress in mental performance can occur if the period of nutritional deprivation was at ages over six months.[80] He reports that language was the function most affected and with the slowest rate of return to normal. If this is correct, postnatal growth retardation selectively damages different behavioral areas than prenatal factors that lead to low birth weight infants. Among several hundred premature and undersized American Caucasian and Negro children examined eight to 10 years after birth, it was found that reading and spelling skills were only minimally influenced but that performances on arithmetic and comprehension tests were significantly diminished.[81]

Other authors have added cautionary notes to the general topic. Usher (1970) points out that fetal malnutrition may have congenital or clinical causes associated with it that have nothing to do with maternal diet.[82] Osofsky (1969) warns against extending extreme animal starvation experiments to humans.[83] Many emphasize that hunger is part of a constellation of factors that can inhibit the somatic and mental development of poverty-class children.[84] This has stimulated emotional articles lamenting social

[78] Joaquin Cravioto, "Malnutrition and Behavioral Development in the Pre-school child," *Pre-school Child Malnutrition: Primary Deterrent to Human Progress,* National Academy of Sciences Publishing Office, Washington D.C., 1966, pp. 74-84.

[79] Myron Winick, Irving Fish and Pedro Rosso, "Cellular Recovery in Rat Tissues After a Brief Period of Neonatal Malnutrition," *Journal of Nutrition,* Vol. 95, pp. 623-626.

[80] J. Cravioto, "Complexity of Factors Involved in Protein-Calorie Malnutrition," *Bibliotheca Nutritio et Dieta,* No. 14, 1970, pp. 7-22.

[81] G. Wiener, R. V. Rider, W. C. Oppel and P. A. Harper, "Correlates of Low Birth Weight. Psychological Status at Eight to Ten Years of Age," *Pediatric Research,* Vol. 2, 1968, pp. 110-118.

[82] Robert H. Usher, "Clinical and Therapeutic Aspects of Fetal Malnutrition," *Pediatric Clinics of North America,* Vol. 17, No. 1, 1970, pp. 169-184.

[83] Howard J. Osofsky, "Antenatal Malnutrition: Its Relationship to Subsequent Infant and Child Development," *American Journal of Obstetrics and Gynecology,* Vol. 105, 1969, pp. 1150-1159.

[84] Ernesto Pollitt and Henry Ricciuti, "Biological and Social Correlates of Stature Among Children in the Slums of Lima. Peru," *American Journal of Orthopsychiatry,* Vol. 39, 1969, pp. 735-747; Ernesto Pollitt, "Ecology, Malnutrition and Mental Development," *Psychosomatic Medicine,* Vol. 31, 1969, pp. 193-200; Rose E. Frisch, "Present Status of the Supposition that Malnutrition Causes Permanent Mental Retardation," *American Journal of Clinical Nutrition,* Vol. 23, 1970, pp. 189-195.

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injustice and the non-Utopian conditions of life.[85] It has even been hinted in a technical article that dominant ruling classes may employ chronic malnutrition to render oppressed groups apathetic and pliable.[86] The consensus remains that diet alone cannot be responsible for human achievement.

What has cogency for human populations is the mild-to-moderate malnutrition that is far more common than overt starvation and which may produce sub-clinical damage that is harder to detect. Cases drawn from hospital samples are more likely to be "moderate" than "mild" and thus bias the findings. Retrospective information on feeding habits is too inaccurate to classify ward patients into "mild" and "moderate" malnutrition categories.

Scientists oriented toward environmentalist explanations have been too hasty in assigning nutritional causes to smaller heads, lesser brain weights, lower IQ scores, and inferior school grades. Differences on these indices for various social and racial groups cannot be ascribed to an occasional case of Kwashiorkor detected in a ghetto. A few instances of pathological neglect cannot contaminate national averages. In the United States, Kwashiorkor and marasmus are in fact more prevalent among American Indians.[87] This racial minority occupies a socio-economic stratum considerably below that of the Negro and is likewise suffused with a feeling of despair over academic and occupational opportunities. Nevertheless, Indians manage to outperform American Negroes on a number of school achievement tests (Kuttner, 1968, 1970).[88] Geneticists zealously commited to environmental influences attribute this inverted ranking to the benefits of more complete integration for Indians.[89] This carefully ignores the fact that the greatest gap between the disadvantaged Indian and the Negro is in the first grade on tests given a few weeks after classes

[85] Alfred D. Klinger, Robert Mendelsohn and Jaqui Alberts, "A Reply to Dr Herbert Pollack Re: Hunger USA," *American Journal of Clinical Nutrition,* Vol. 23, 1970, pp. 677-683.

[86] Heinz F. Eichenwald and Peggy Crooke Fry, "Nutrition and Learning," *Science,* Vol. 163, 1969, pp. 644-648.

[87] Jean Van Duzen, James P. Carter, John Secondi and Charles Federspiel, "Protein and Calorie Malnutrition among Pre-school Navajo Indian Children," *American Journal of Clinical Nutrition,* Vol. 22, 1969, pp. 1362-1370.

[88] Robert E. Kuttner, "Utilization of Accentuated Environmental Inequalities in Research on Racial Differences," *Science,* Vol. 160, 1968, pp. 439-440 (Abstract); Robert E. Kuttner, "Comparative Performance of Disadvantaged Ethnic and Racial Groups," *Psychological Reports,* Vol. 27, 1970, p. 372.

[89] Walter F. Bodmer and Luigi Luca Cavalli-Sforza, "Intelligence and Race," *Scientific American,* Vol. 223, 1970, pp. 19-29.

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commence, a period much too short to reverse six years of relatively more severe deprivation. This fatal readiness to minimize or overlook genetic and racial factors weakens much of the current work on environmental and nutritional forces in human development.

Before protracted hunger can be blamed for mentally crippling multitudes of children in the United States, a helpful preliminary would be the demonstration that a condition of near-famine exists in poverty pockets. Such proof is lacking for most segments of the population. Migrant workers and some rural Blacks may subsist on atrocious diets but epidemic famine seems to be the hysterical invention of journalists and political candidates. The vast majority of black pre-school children in rural Mississippi do not manifest the signs of severe malnutrition.[90] Hemoglobin values in black adolescents in urban Alabama meet acceptable standards.[91] In California, black children in some age groups may be taller and more obese than white.[92] Blood tests did not uncover any alarming degree of serum protein deficiency or a vitaminosis among poverty and public assistance families in metropolitan New York.[93]

In some communities, the intake of some nutritive elements may be superior for black adolescents even in schools without a subsidized lunch program.[94] A diet resembling that consumed by the Appalachian poor Whites gave satisfactory nitrogen retention in growing children with only 46 grams of protein per day.[95] Anemia in pre-school black urban children from several geographic areas was found to be low, and never more than a few per cent. Some of this can be attributed to genetic hemoglobinopathies

[90] George M. Owen, Philip J. Garry, Kathryn M. Kram, Carl E. Nelson and J. M. Montalvo, "Nutritional Status of Mississippi Pre-school Children: A Pilot Study," *American Journal of Clinical Nutrition*, Vol. 22, 1969, pp. 1444-1458.

[91] W. A. Daniel, Jr., and A. M. Rowland, "Hemoglobin and Hematocrit Values of Adolescents: Nutritional Survey of Low Income Groups," *Clinical Pediatrics*, Vol. 8, 1969, pp. 181-184.

[92] Robert B. Bradfield and Dorothy Coltrin, "Some Characteristics of the Health and Nutrition Status of California Negroes," *American Journal of Clinical Nutrition*, Vol. 23, 1970, pp. 420-426.

[93] Robert G. Newman and Suzanne Martin, "The National Nutrition Survey in New York City," *Transactions of the New York Academy of Sciences*, Vol. 33, 1971, pp. 316-326.

[94] Marion A. Wharton, "Nutritive Intake of Adolescents: A Study in Southern Illinois," *Journal of the American Dietetic Association*, Vol. 42, 1963, pp. 306-310.

[95] R. P. Abernathy, S. J. Ritchey, Mary K. Korslund, J. C. Gorman and N. O. Price, "Nitrogen-Balance Studies with Children Fed Foods Representing Diets of Low-Income Southern Families," *American Journal of Clinical Nutrition*, Vol. 23, 1970, pp. 408-412.

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such as the sickling trait.[96] The malnutrition hypothesis does not fit the evidence for the United States and for most industrialized sectors of the world.

It is widely agreed that white babies weigh more at birth than black babies.[97] Race, nutrition, age of mother, parity and many other factors may underlie the slight weight advantage of white infants. How much this small difference of uncertain origin contributes to the final level of intelligence attained is presently unknown. It is soundly based opinion that birth weight correlates positively with intelligence,[98] and that very low weight infants seem destined to show mental or behavioral handicaps.[99] The pre-school intelligence of undersized infants, however, is not always deficient.[100] Prematurity and underweight full-term infants may occur from many causes, some of which may not block accelerated growth to normal dimensions. When head size remains abnormally small due to congenital factors, disease, or birth trauma, it then inevitably becomes associated with low grade intellect.[101] Prematurity by itself or undernutrition during infancy does not prevent a "catch-up" phase of rapid brain and head growth.[102]

How this phenomenon relates to newborn racial weight differences amounting to only a few ounces cannot be guessed.

[96] H. A. Pearson, I. Abrams, D. J. Fernbach, S. P. Gyland and Dorothy A. Hahn, "Anemia in Pre-school Children in the United States of America," *Pediatric Research,* Vol. 1, 1967, pp. 169-172.

[97] E. Z. Moyer, H. J. Kelly, I. C. Macy, H. C. Mack, P. C. DiLoreto and J. P. Pratt, *Nutritional Status of Mothers and Their Infants,* Children's Fund of Michigan Detroit, 1954, p. 30; Malcolm G. Freeman, William L. Graves and Rita L. Thompson, "Indigent Negro and Caucasian Birth Weight-Gestational Age Tables," *Pediatrics, Vol.* 46, 1970, pp. 9-15.

[98] R. G. Record, Thomas McKeown and J. H. Edwards, "The Relation of Measured Intelligence to Birth Weight and Duration of Gestation," *Annals of Human Genetics,* Vol. 33, 1969, pp. 71-79.

[99] Cecil M. Drillien, "The Incidence of Mental and Physical Handicaps in School-age Children of Very Low Birth Weight: II," *Pediatrics,* Vol. 39, 1967, pp. 238-247; John A. Churchill, Joseph W. Neff and Donald F. Caldwell, "Birth Weight and Intelligence," *Obstetrics and Gynecology,* Vol. 28, 1966, pp. 425-429.

[100] S. Gorham Babson and John Kangas, "Pre-school Intelligence of Undersized Term Infants," *American Journal of Diseases of Children,* Vol. 117, 1969, pp. 553-557.

[101] Helen B. Pryor and Hulda Thelander, "Abnormally Small Head Size and Intellect in Children," *Journal of Pediatrics,* Vol. 73, 1968, pp. 593-598.

[102] S. Gorham Babson, "Growth of Low-Birth-Weight Infants," *Journal of Pediatrics,* Vol. 77, 1970, pp. 11-18; Melvin De Levie and M. B. Nogardy, "Rapid Brain Growth Upon Restoration of Adequate Nutrition Causing False Radiologic Evidence of Increased Intracranial Pressure," *Journal of Pediatrics,* Vol. 76, 1970, pp. 523-528.

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That the scope of environmental remedies is limited can be deducted from data summarized by Knobloch and Pasamanick (1961).[103] These workers find that premature Whites are only slightly impaired by several developmental criteria at 40 weeks of age relative to normal weight non-white control infants. If a few ounces of weight difference between normal white and black infants represented an overwhelming obstacle to neurobiological development and the attainment of full intellectual potential, then the much greater difference between premature Whites and normal-weight Blacks could not have been bridged by average care.

Perhaps the only investigation seeking to link cranial volumes of full-term, normal-weight infants to maternal blood amino acid concentrations was conducted by Churchill and colleagues (1969) on low socio-economic class Blacks. In this pioneer study, heavier babies with larger heads resulted from mothers with higher serum amino acid levels.[104] However, some of the impact of this observation is lost since dietary protein intake could not be correlated with blood amino acids by retrospective interviews on eating habits. At the same time, total amino acid nitrogen is a crude index of protein intake. A moderate deficiency may decrease one group of essential amino acids and transiently increase some of the non-essential blood components with the fluctuations cancelling each other out. But any direct attack is to be applauded in a field rife with speculation.

Finally, in a valuable review, Altman and co-workers (1970) offer the insight that undernutrition during gestation and lactation may come late enough to interfere with the formation of micro-neurons in some species.[105] These elements are featured in the "fine wiring" of the brain and a reduction in numbers or in functional capacity could have consequences out of proportion to the visible deficits. The gross anatomy of the brain would not be modified but higher activities could be compromised. Anthropologists could study crania and anatomists could study brains which appear metrically equivalent but which have contents and capacities of widely differing potential. Even after the full complement of neuronal cells is laid down, severe malnutrition may

[103] Hilda Knobloch and Benjamin Pasamanick, "Some Thoughts on the Inheritance of Intelligence," *American Journal of Ortho-Psychiatry*, Vol. 31, 1961, pp. 454-473.

[104] J. A. Churchill, K. S. Moghissi, T. N. Evans and C. Frohman, "Relationships of Maternal Amino Acid Blood Levels to Fetal Development," *Obstetrics and Gynecology*, Vol. 33, 1969, pp. 492-495.

[105] Joseph Altman, Gopal D. Das and Kiran Sudarshan, "The Influence of Nutrition on Neural and Behavioral Development: I. Critical Review of Some Data on the Growth of the Body and the Brain Following Dietary Deprivation during Gestation and Lactation," *Developmental Psychobiology*, Vol. 3, 1970, pp. 281-301.

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damage non-neuronal glial cells that provide vital auxiliary services to the neural network (myelinization of axons, etc.). The site of nutritional injury may well await the arrival of micro-anatomists before the question is settled.

Outside the United States nutritionists have no difficulty in locating areas of acute and chronic food shortages. War-ravaged countries typically experience a decline in newborn birth weights (e.g. Dean).[106] Incomplete data from the Wuppertal, Germany, postwar project does not support the popular belief that lactation is interfered with. An unexpected dividend is that smaller babies require fewer potentially damaging forceps deliveries.

The full magnitude of the effects of wartime hunger on newborn weights is revealed in the often quoted figures for the Leningrad siege of 1942. Almost 50 per cent of the infants were five pounds or less at delivery.[107] Such stark deprivation would be unusual in any minority ghetto yet Russian authorities report no educational problems at that urban center. More to the point, the chronic hunger in Poland between 1939 and 1945 caused by two invasions and a deliberate starvation diet has not led to epidemic feeble-mindedness in Polish schools nor to the type of behavioral problems encountered in American ghetto families. An English-language summary of medical observations on Polish infants surviving German concentration camps discloses only minor adjustment difficulties and petty emotional disturbances when adult years are reached.[108] These symptoms are of the same order of seriousness as displayed by physically fit Danish police and Resistance fighters who were repatriated from a much milder internment.[109] Since these prisoners were fully grown and no longer in their vulnerable childhood years, and yet showed an appreciable incidence of lingering neuroses, we may suspect that all behavioral changes following under-nutrition in childhood are not the product of a unique susceptibility to psychic damage. The Polish experience even suggests that European children are not as vulnerable to irreversible nutritional lesions as are non-Caucasians elsewhere.

[106] R. F. A. Dean, "The Size of the Baby at Birth and the Yield of Breast Milk," *Studies of Undernutrition, Wuppertal 1946-9,* Medical Research Council Special Report Series No. 275, H.M. Stationery Office, London, 1951, pp. 346-378.

[107] A. N. Antonov, "Children Born During the Siege of Leningrad in 1942," *Journal of Pediatrics,* Vol. 30, 1947, pp. 250-259.

[108] Wanda Poltawska, "Children Who Were There," *Poland Illustrated Magazine,* Polish Interpress Agency, Warsaw, No. 7, (167), 1968, pp. 36-37.

[109] P. Helweg-Larsen, H. Hoffmeyer, J. Kieler, E. H. Thaysen, J. H. Thaysen, P. Thygesen and M. H. Wulff, "Famine Disease in German Concentration Camps, Complications and Sequels," *Acta Psychiatrica et Neurologica Scandinavica, Supplementum 83,* 1952.

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Protein malnutrition and wasting diseases are rampant in Black Africa due to poverty, ignorance, and cultural practices such as long, continued breast nursing.[110] Although a food inventory would startle a nutritionist, a judgment based on European standards of adequacy could be misleading. For example, tropical climates require about 16 fewer calories for every Fahrenheit degree of temperature increase.[111] It is thus conceivable that Canadians or Swedes would hover perilously close to starvation on a caloric intake suitable for a clerk in the Congo. Nor can it be automatically assumed that breast feeding is a nutritional disaster. On quite poor diets, Bantu mothers manage to secrete milk with a higher protein content than American or English mothers.[112]

Research in Latin and Central America faces an identical problem. For lack of appropriate local norms, weight and growth curves are often calculated against North American standards. This introduces a cross-racial comparison into the nutritional equation. No easy solution is pending. The construction of a normal sample is likely to include upper-class Hispano or European Whites while the poverty families are Mestizo or Indian for the most part. With these populations, the possibility of adaptation to meager diets must be kept in mind. It has been suggested that the short stature of Central American natives resulted from evolutionary selection against genes for rapid growth. In line with this is the observation that the pattern of skeletal maturation as determined by bone ossification scarcely differs in children from El Salvador and Nicaragua though only 9 per cent of the citizens of the former have deficient protein intakes as contrasted to 70 per cent of the latter.[113] Another factor to be considered is that the physical growth of some Indian sub-populations may have been influenced by adaptation to high altitudes.[114]

[110] Report of Second Inter-Africa Conference on Nutrition, *Malnutrition in African Mothers, Infants and Young Children,* H.M. Stationery Office, London, 1954.

[111] Jean Mayer, "Nutrition and Civilization," *Transactions of the New York Academy of Sciences,* Vol. 29, 1967, pp. 1014-1032.

[112] A. R. F. Walker, "Certain Biochemical Findings in Man in Relation to Diet," *Protein Nutrition,* Annals of the New York Academy of Sciences, Vol. 69, 1958, pp. 989-1008.

[113] A. Roberto Frisancho, Stanley M. Garn and Werner Ascoli, "Childhood Retardation Resulting in Reduction of Adult Body Size Due to Lesser Adolescent Skeletal Delay," *American Journal of Physical Anthropology,* Vol. 33, 1970, pp. 325-336.

[114] A. Roberto Frisancho and Paul T. Baker, "Altitude and Growth: A Study of the Patterns of Physical Growth of a High-altitude Peruvian Quechua Population," *American Journal of Physical Anthropology,* Vol. 32, 1970, pp. 279-292.

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In summary, the cumulative weight of the above criticisms and objections makes the argument for the overriding importance of environment and nutrition very tenuous and speculative. Except under extraordinarily harsh conditions, brain size and behavioral capacity for humans seems to be determined by predominantly intrinsic factors.

SUMMARY

The physical substratum of behavior in both man and animal is the central nervous system. Like other body structures, the dimensions and properties of this system are largely predetermined by the forces of heredity. Twin and family studies demonstrate that 60 per cent to 80 per cent of the individual differences in intelligence test performance can be assigned to genetic factors, that resemblances in the fissural and convolutional patterns of the brain are related to genetic kinship, and that the normal human EEG is almost completely genetically determined. That the capacity of any functioning system is fixed by genes is fully in accord with evolutionary mechanisms. The experiential content may be subject to some variability if sampling is from diverse cultures. However, most mental tests deal with universal qualities (e.g. language, arithmetic, memory, space perception, etc.) that are fundamental skills acquired by all individuals sharing a common social environment. When comparisons are made on classes or races drawn from a single civilization which shapes life styles at every socio-economic stratum, then performance differences can be safely assigned to the biological endowments of the measured groups with only minor fluctuations caused by environmental influences.

Animal research has shown that stimulus-rich environments or special handling techniques during early development may result in moderate anatomical and chemical changes in the brains of some species. Even if contrary findings are ignored, these results are not applicable to human populations as an explanation of brain or behavior differences between races or classes. The sensory inputs necessary to foster cerebral development are quantitatively much the same for all human populations and cultures.

Extreme nutritional deprivation in the prenatal and early infancy periods has been reported to affect adversely brain development and to produce behavioral and learning deficits in some animal studies. Again extrapolation to human populations to account for group differences in brain structure and functioning does not appear warranted. The dietary deficiencies of ethnic

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groups and social classes in the United States and other industrialized countries in no way approach the degree of protein-calorie restriction imposed on test animals. Exceptional instances of starvation would not change group means. With regard to adult brains, even severe malnutrition produces little or no permanent damage. In any event, the famine and food shortages produced by wars and their aftermath in Europe and Asia have not resulted in any observable intellectual deficiencies in the populations of those areas. The smaller cranial capacities found among the peoples of Africa, Latin America, and some parts of Asia are more likely caused by the prolonged operation of natural selection acting to maximize survival of groups existing under marginal conditions.

IMPORTANT REPRINT

Practical Considerations which are Fundamental in Bantu Affairs in Rhodesia and for an Understanding of Negroid-Caucasoid Problems Generally

by R. GAYRE OF GAYRE

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A Consideration of the Bushman "Click" in Relation to Ethnological Classification

By R. GAYRE OF GAYRE

Formerly the view held of the origins of the Cappoid peoples (the Bushmen and Hottentots) was that they were of Mongoloid origin. For example, Hooton, the distinguished anthropologist of Harvard University, held this view, and so it appears in his earlier publications. Later, however, this view became discarded, and so the later editions of Hooton's work accepted the commonplace view of today, that they were of independent origin.

In my own exposition of the relationship of the various groups of mankind I have rejected this view which is now prevalent for what I consider to be decided salient reasons. As an advocate of parallel development I would readily accept the new theory of an independent origin for the Cappoids, if it did not call for so many explanations as to why these two stocks have so many traits in common, that I consider that that position is untenable.

The Mongoloids and Cappoids both have a yellowish skin, slanting and screwed-up eyes, epicanthic folds, broad faces, high cheek bones, the Mongolian blue spot, and a short stocky frame. These are too many traits shared in common to be explained away as mere homologies due to parallel development.

In my discussions of the three basic species of mankind, especially where discussing the ABO blood groups, I have postulated a widespread distribution of a proto-Mongoloid stock, which probably, at the *Homo erectus* stage, was entirely, or almost entirely of the O blood group. Later, in the heartlands, or regions where the typical Mongoloid of our times evolved, there were, according to my views, mutations for the B blood group. These lands were probably those regions that comprise the Himalayas, Tibet, and stretching into Mongolia. The consequence is that we would have a widespread, early proto-Mongoloid distribution throughout large areas of the world which would be largely of the O blood group; and then inside this ring of earlier Mongoloids, in these inner regions of Mongolia, there would be the more characteristic and later-evolved Mongoloids, characterised by a high B blood group.

It should be emphasised that while we see such a schematic distribution of an outer ring of mainly O Mongoloids, and a

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heartland of B, this cannot be reflected in an absolute and inflexible exactitude in the resultant distributions. First of all there have been widespread invasions of eastern and southern Asia by Caucasoids throughout history and prehistory, pouring out from their original base in the lands of western Russia stretching away to the northern Siberian plain, which must have carried the A blood group into the indigenous populations, just as we believe similar Caucasoid invasions of Africa did into the Negroid peoples. Secondly, from the Australoids, and particularly the Ainoid part of them, there was transmitted the A blood group up the west coast of the Pacific, along the shores and islands of eastern Asia. Even today, after considerable intermixture with Mongoloids, and the Japanese in particular, most surveys of the Ainu show a significant predominance of the A blood group over the B. Thirdly, from migrants of prehistoric times who came from Central Asia, such as those that passed through India, or westward along the mountain chains into western Asia, there has spilt over into Africa immigratory peoples with the B blood group.

In addition, as we have suggested elsewhere, it is possible that natural selection does not affect the ABO blood as efficiently as the other traits which we use for taxonomic classifications of races. If this is so anomalies will arise from this cause as well. Besides this, mutations are probably occurring all the time, and constantly modifying the blood group frequencies in different groups of peoples.

Nevertheless, speaking in general terms, the original distribution of an early Mongoloid strain which was mainly O and later OB, will be perceptible, and the anomalies will, in many cases, be explicable by an ethnological synthesis of the racial origins.

The early proto-Mongoloids, mainly of the O blood group, spread into southern China, Indo-China, Malaya, and became, as a consequence, an element in the ultimate creation of the Malayo-Polynesian peoples, in combination with some crosses with the eastern Negroid, Australoid and, at a later stage, even with Caucasoids — especially in the Polynesians.

The evidence suggests that the Melanesian languages all derive from a common language which was probably spoken from B.C. 2000 to 3000 along the south coast of China. This is indicative of a probable Mongoloid element in many of the Melanesians. We find this indicated by a lighter skin, straight, as well as the typically very curly or woolly, Negroid type of hair, heavy jaws, and lack of the broad Negroid type of nostrils. It is hard to escape the conclusion of an early Mongoloid strain throughout parts of Melanesia, and in the Malayo-Polynesians in general. This would appear to be due to the arrival about B.C. 1000 of Malayo-Polynesian-speaking peoples from south-east Asia.

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Turning to the west, away from the Pacific, there seems every reason to believe that the early proto-Mongoloid stock penetrated into Africa. We are at one with Professor Coon in seeing in the Ternifinian people (of Algeria) and other related peoples, an advanced *Homo erectus* type with cultural and dental affiliations with Pekin man.[1] This stock had a broad cranial base (which is common to Mongoloid and Cappoid) as well as teeth which have slight Mongoloid appearances. According to Professor Coon these peoples had two hundred and fifty thousand years of evolution in Africa, and they have resemblances to the *Homo erectus* types as seen in the mid-Pleistocene of China.[2]

Professor Coon believes that Ternifinian stock is an ancestral one to the Cappoid, because of the latter's resemblances to the Mongoloids, in respect of such traits as facial flattening, skin colour, slight shovelling appearance of the upper incisors, and enamel pearls on some upper molars.

With Professor Coon we believe that this stock was displaced by the Mouillians and Capsians along the Mediterranean coastland lands of North Africa.

These Ternifinians were tall Cappoids. We believe that the stunting is in response to certain climatic selective factors. Whether it had already occurred at this time, and there were already in existence short people of the same stock, or whether this occurred later, is hard to say at this stage of our knowledge. Undoubtedly, if it occurred later, it would have been in response to the conditions in which the Cappoids have evolved through the ages, which made the short stature, small body size and weight, and steatopygy factors which aided survival in harsh and arid conditions.

Incidentally, I would like to point out that on every count, including that of folklore, and having regard to Hamitic linguistic traces in the speech of the Hottentots, and the latter's pastoralism and cattle, we have clear indications of a northern origin for all the Khoisian-speaking peoples of southern Africa. Therefore, since this is so, it is a most misleading usage to employ a term which implies a Cape origin for them. For that reason I have spelt the term Capoid, by which they are generally known, and which infers a Cape origin, as *Cappoid*. Technical terms for races are necessary, but wrong inferences can be given when the terms imply geographical locations. The term Nordic (which is too well established to change) supports the idea of origin in the Nordic countries of Europe, whereas I consider the origin came

[1] *Anthropology: A to Z* (edited by Carleton S. Coon and Edward E. Hunt), New York, 1959, p. 138.

[2] *Anthropology: A to Z, op. cit.*, p. 139.

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from east of the Urals. Furthermore, Caucasoid (again too well established to change) implies that the Caucasus was the source (as some once believed) of the White races, and so on. At least in this case, since I believe the evidence is overwhelming that the Khoisian peoples were not even of African origin originally, it seems better to transform the name, to remove from it the suggestion that they came from the Cape Province and adjacent areas of Africa, by calling them Cappoids rather than Capoids (or Cape people).

If our theory is correct, we see in the southern African Cappoid peoples, and in the quasi-Mongoloid elements found in some of the black Melanesians, stocks which have had at one time a common origin, no matter how different they may look today — and that origin was from the proto-Mongoloids who were pushing outwards from the Mongoloid heartlands before the true and later typical Mongoloids had evolved.

In northern China, Manchuria, and across the Bering Straits and so into America, we have other Mongoloids, who range from those who belong to the outer ring of Mongoloids in America, the Amerindians, and are characterised by the O blood group, to those who, mixed as they may be with other elements, are part of the same earlier Mongoloid types.

Therefore, in point of fact, incredible as it may seem at first sight, in the Bushmen and the Hottentots, in some submerged strains of the Melanesians, in elements to be found in north-east Asia, and in peoples throughout much of America, in the Amerindian races, we have widely scattered stocks, in various degrees of heterogeneity, of an original proto-Mongoloid stock.

Having grasped this salient fact we are in a position to deal with the peculiar clicks which characterise the Khoisian languages.

Some authorities in the past have pointed out that this peculiarity is not restricted to the Bushmen and Hottentots, but is found in some of the Bantu peoples, such as the Zulus and Khosas, and therefore it is not characteristic solely of the Khoisian languages. This is true as far as it goes. But the short answer to this is that these Bantu tribes have acquired the clicks from the Cappoids, whom they had overrun and whose women they had taken. The fact of the matter is that the clicks dominate in the Khoisian languages, whereas in the Bantu it is the plain non-click consonants which are fundamental.

Attention should be drawn to the fact that clicks are not restricted to the Khoisian (and certain Bantu people who have derived them from the Khoisian-speaking peoples), since they are found throughout the whole equatorial belt of the world, according to some experts in linguistics.

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When we examine the distribution within this climatic belt we find that the clicks have been traced in the Malayo-Polynesian tribes, and the Incas and Aztecs of Central America.

The Q, which is recorded by R. H. Codrington and Bishop J. C. Patteson in the Malayo-Polynesian languages, represents a click type of speech. While the Quichua (Peruvian Incas) originally possessed the click sounds which gradually evolved into gutturals. Among the Nahuatl (Aztecs) there were also clicks, and they are still to be found among those of them who live in the highlands of the interior. The *tl* sound, found as an affix or suffix, is exactly the same as the Khoisian dental click.

In addition, we learn that it is not entirely restricted to the equatorial world, as it has been found in parts of northern China. In connection with this association with China, it should be observed that Jens Bjerre[3] has observed that there is a resemblance between the Bushman speech and that of the Chinese, in that it depends on the forcefulness with which the clicks and other sounds are pronounced to decide what is the meaning of the sounds made. The slightest difference in the sound of the click changes the meaning of the word[4] and this has parallels with Chinese, where differences of sound, although with the same word-forms, changes the meaning.

Bearing in mind that all these stocks, according to the theory I have enunciated, are all of proto-Mongoloid derivation, or share some antecedents which go back to that earlier type of Mongoloid, it is very significant that the survival of the click is to be found among people of that strain, and is not found in any others (except some of the Bantu who are known to have derived it from the Khoisian peoples).

That clicks in the speech (and in some cases the forcefulness of their delivery having linguistic significance) is characteristic of these earliest Mongoloids who spread outwards in all directions before the typical Mongoloids, as we now know them, had evolved to their characteristic type (as best seen in such as the Tibetans and adjacent peoples) suggests that this is a very archaic mode of proto-Mongoloid speech. The fact that they preceded the gutturals in the Aztec speech suggests that these sounds are primitive. Consequently, it would be expected that they would have been lost by now in the languages of the Mongoloid peoples, and those who derive linguistic forms from them, and they have only been retained by some of the peoples in the outer fringe of this stock, as in the case of the Bushmen.

In the very nature of things, until we have much more research,

[3] Jens Bjerre, *Kalahari*, London, 1960, p. 103.

[4] Elizabeth Marshall Thomas, *The Harmless People*, Secker and Warburg, London, 1960, p. 21.

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and the synthesis of it carried out to a much greater degree than is possible at the moment, we cannot afford to be dogmatic. But it does seem to me that when we consider the affinities between the Ternifinians of Algeria and northern Africa to the evolving Mongoloid stock on the one hand, and the Cappoids on the other, and the fact that the other peoples mentioned in Asia and America are related to the Mongoloids also, that there is more justification for considering the Cappoids as an ancient branch of the Mongoloid stem than for the view of their being evolved from an entirely different stem by a parallel development.

If this is so then the earlier views concerning the classification of the Cappoids is supported. In that case when the Dutch arrived at the Cape and called the Hottentots the *Chinese* Hottentots they may not have been far from the mark if we think of the Mongoloid basis of the Chinese and forget that they have also Caucasoid and Ainoid elements in them.

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The Makú Indians and Racial Separation in the Valley of the Rio Negro

By FRANCIS J. KNOBLOCH

INTRODUCTION

There are some regions of the world, protected by almost inaccessible mountains or tropical forests, which contain areas which in ethnology may be called refugee areas. An ethnological map of these regions reveals a mosaic of many tribes and languages, often of the most diverse ethnological stocks. The most famous of these refugee areas are the Caucasus Mountains and north-central California. In South America there are similar areas, such as the Fireland, the Gran Chaco, the Upper Xingu and the drainage area of the Uaupés river, a tributary of the Rio Negro in north-western Brazil.

The following tribes inhabit Brazilian territory on the Uaupés river:

1. Betoya language family: Tukano, Dessano, Pira-Tapuia, Uanano, Tuyuka, Miriti-Tapuia, Arapaço, Carapaná and Kubéowa.
2. Aruakian language family: Tariana.
3. Makú language family: a collection of small nomadic families.

GEOGRAPHICAL NOTES

The territory occupied by the small groups of Makú is situated roughly between longitudes 60° and 70° West, and latitudes 1° and 1°30′ North. This area lies between the Rio Negro and Rio Uaupés to the north and the Japurá river in the south. The whole of this area is densely wooded with tropical rain forest, and the climate is typical of the Amazon — humid and hot. Its flora and fauna are generally similar to those found along the whole valley of the Amazon.

MAKÚ GROUPS

Antonio Giacone[1] names the following six "families" of Makú:

Dometende, who live near the Jauareté mission.

Moicotende. There are two families called Moicotende. One

[1] P. Antonio Giacone, *Pequena Gramatica e Dicionario Portugués-Ubde-Nehern ou Macú*, Escolas Graficas Salesianos, Recife, 1955, p. 5.

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group live in the Serra Porcos, 15 kilometres from Jauareté, the other in the forests between the Uaupés and Tiquié rivers.

Competende, who live along the upper Japú-Igarapé, a small tributary of the middle Uaupés river.

Techaatende, who live in the neighbourhood of the village of Iaritĺ, near the Rio Tiquié.

Namcotende, who inhabit the right bank of the Rio Negro from the mouth of the Uaupés to the Tapuruquara.

There are other small groups, such as the Makú of the Irá-Igarapé, the Makú of the upper Castanha-Igarapé and a small group of the Umari-Igarapé on the upper Tiquié. The chief of this group told me that it calls itself Wauro, a name which is generally used to designate a member of the most noble class of the Tukano tribe. A small group of Makú also still exist in Colombia, on the Rio Traira, a tributary of the Apoporis.

The Namcotende who live between the Rio Negro and the Rio Japurá are divided into two divisions — the Nadöbö (eastern) and the Anodoeub (western). Among the Nadöbö the best-known families are the Kabari of the upper Rio Uineixi. The Tucano Bibiano Vasconcelos told me that in the same region there still exists a tribe whom Whites call "Piranhas," a dangerous fish common to Amazon waters. The "Piranhas" remain hostile towards white people and have avoided their influence.

On the Paraná Boá-Boá, a tributary of the River Japurá, there lives a small group of Makú who, like the Uariua of the middle Japurá, belong to the "wild" Guariba.[2] Settlers of the Tukano tribe on the banks and islands of the Rio Negro call the Makú groups who live between the Negro and Japurá rivers the Shiriwai. Schultz[3] states that the Makú of the Boá-Boá river call the Kabari of the Rio Uineixi the Manoide and look upon them as their relatives. The Kabari's own name for the Boá-Boá group is Makú. Schultz gives the word *cabori* for man. It seems likely that Kabari or Cabori may be their own name for the whole group. It is worth noting that two streams, tributaries of the Rio Tiquié, are called Cabari-Igarapé, and the Tukano chief Padilha told me that the first inhabitants of Tiquié were the Cabari.

CLASSIFICATION

The Makú who live between the rivers Uaupés and Tiquié call their language Hubde-nehern (*hub*, man; *hubde*, men; *nehern*,

[2] C. Tastevin, "Les Makú du Japurá," *Journal de la Societé des Americanistés*, Paris, Vol. XV, 1923, pp. 99 ff; Harald Schultz, "Ligeiras notas sôbre os Makú de Parana Boá-Boá, *Revista do Museu Paulista*, Vol. X, 1959, pp. 109 ff.

[3] Harald Schultz, *op. cit.*, pp. 110 ff.

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language).[4] In an ethnological map, Loukotka[5] classifies the Makú as an independent linguistic family, including (as well as the people already described) the Yapuoas, who live between the rivers Uaupés and Içana, and the Puinave, who inhabit the banks of the Rio Inirida, a tributary of the Guaviare, in Colombia.

The term Makú has been applied incorrectly to some other tribes of completely different linguistic stock, such as the "Makú of the Cauaboris," belonging to the Yanoname family, and the Piaroa-Makú, who form a separate linguistic family. The M'á ku (Makú) of the Serra Parima of the Roaima territory also form their own family. The Macúna (Makú with black skins) have been identified by Koch-Grünberg as a group of Tukano.[6]

HISTORICAL NOTES

The Makú affirm that they are the original inhabitants of this region. When the other Indians (Betoya and Aruak) invaded the land, the Makú were defeated, were forced to cede the land to the invaders and retreated to the interior forests, where they occupied the headwaters of small brooks. This tradition seems to be true. In the Tukano language the Rio Uaupés is called *Dya Poxsá* (Rio dos Makú). Wenceslao Padilha, an old chief of the Tukano village of Alta Bareira on the Rio Tiquié, a tributary off the right bank of the Uaupés, told me that the first inhabitants of the Tiquié were the Cabari (Makú).

Missionaries of the Carmelite order seem to have made an attempt to settle some Makú together with other tribes in villages. In the accounts of Noronha, Sampaio and Ferreira in the eighteenth century there is reported that the Makú inhabited the following villages on the Rio Negro: Maupi, Santa Isabel, Sao Antonio de Castanheiro Novo, Nosa Senhora de Nazaré de Curianá.[7]

Among more than 60 villages founded during the last 50 years by Salesian missionaries, only three have a partly Makú population: Paxiuba-Igarapé on the Uaupés river, and Piracuara and Jandu on the Papurí river.[8]

[4] P. Antonio Giacone, *op. cit.*, p. 5.

[5] Cestmir Loukotka's map, "Ethno-Linguistic Distribution of South American Indians" appear in *Classification of South American Indian Languages* (edited by Johannes Wilbert), University of California Press, Los Angeles, 1967.

[6] Theodor Koch-Grünberg, *Zwei Jahre unter den Indianern Nordwest-Brasiliens*, Stuttgart, 1921, p. 379.

[7] P. Alcinilio Brüzzi Alves da Silva, *A Civilisazao Indigena do Uaupés*, Missao Salesiana do Rio Negro, Sao Paulo, 1962, p. 41.

[8] This is my own information.

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A document written by Brother Marchetti, a Franciscan missionary, in 1885 absolutely prohibits the selling, buying and hunting of Makú.[9]

ELEMENTS OF MATERIAL CULTURE

All Makú groups are semi-nomadic and a whole group often will move to distant camping places. For instance, from 1960 to January 1961 the Makú of the upper Castanha-Igarapé were camping in the woods near the Salesian mission of Pari-Cachoeira, where I visited them frequently. They were 40 to 50 kilometres from their home area.

The Makú are mainly a hunting and collecting tribe. Only recently under the influence of the missionaries have they begun to grow small plantations.

Their houses are simple. Four beams are used for the four corners, the walls or sides and the roof being covered with leaves of the *açai* or *inaja* palms. Sometimes there are only two sloping roofs, forming with the earth in section a triangle to form one room.

The Makú are the sole producers of beautifully made *balaios* (sieves). These are made from liana stems, and the Makú also manufacture simple hammocks from the fibre of the *tucum* palm. For modesty's sake the Makú wear a *tanga* made from a banana leaf.

Because the Makú have no natural salt available they reduce the bones of hunted animals to ashes and mix them with pepper. As a drink they use *kaxpi*, prepared mainly from the juice of lianas of the genera Banisteria. The Makú are also great users of *ipadú*, a drug which is made from the dried leaves of the *coca* shrub (*Erythroxylon coca L.*) and chewed like tobacco to overcome hunger. It is made in a tube carved from the trunk of a tree in which the dried leaves are reduced to powder with the aid of a wooden pestle. The Makú are the sole producers of *ipadú* in the Uaupés region and their use of it is a cultural element they have in common with the Aymara and Quechua Indians in the Bolivian Highlands.[10]

The Makú are excellent hunters and tapir, monkeys, forest pig, deer and jaguar are the main contributions to their table. Hunting is carried out with bow and arrow, and also with the

[9] This document was discovered by Father Balzola in 1923 in the possession of the Tukano chief of Pari-Cachoeira.

[10] P. Matthias Jacobs, *Wunderland Bolivien*, Kreuzlingen, 1953, pp. 37 ff.

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sarabatana (blowpipe), whose manufacture is exclusively the property of the Makú. They also produce a deadly efficient type of arrow-head poison (*curare*) but refuse to reveal the actual formula they use in its manufacture. On their hunting parties the Makú are accompanied by small dogs. The only domesticated creature I have observed apart from these dogs is a bird, the *Gaviao real*. I once saw a woman call to one of these birds which was sitting in a tall tree. On hearing the woman's loud cry of *wii, wii*, the bird flew down and sat on her outstretched hand without doing her any harm. It immediately reminded me of some noblewoman of the Middle Ages with her hunting falcon.

Besides hunting, the Makú collect wild fruits in the woods, lizards, rats, ants, termites and other insects. Where they live near missions they grow plantations of manioc, yams and the *pupunha* palm.

RELIGION

Very little is known about the religious customs of the Makú. They have medicine men. The girls have an initiation ceremony and as far as I could observe their hair is cut short during this time. A missionary, the late Miguel Blanco,[11] writing about a funeral ceremony, says that all the people come together and are decorated with feather headdresses. After they have buried the body of the dead person they build a great fire on the grave. Afterwards they plant yams in the ashes but only return to the grave when the yams are ripe.

The Makú of the Paraná Boá-Boá, a fork of the Japurà river, have a festival when the fruits of the *pupunha* palm are mature.[12]

PHYSICAL ANTHROPOLOGY

The Makú are small of stature, slender of build and fair skinned, rather like the colour of pale clay. They have abundant black hair, often of a fine texture. The forehead is low and sloping, while the cheekbones hardly show. The nose is high and fine and the eyes are more open than is normal in the Amerindians so that they appear almost Caucasoid. Some Makú have more delicate features than the other tribes.[13] The Makú have a

[11] Miguel Blanco, *O Inferno Verde*, Ediçoes Salesianas, Porto, Portugal, 1962, p. 40.

[12] Harald Schultz, *op. cit.*, pp. 109 ff.

[13] P. Alcinilio Brüzzi Alves da Silva, *op. cit.*, p. 77.

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melancholy expression and some groups, like the so-called Makú of "Sao Gabriel" have a debauched appearance, which is attributed to alcohol.

These racial qualities very much resemble those of the Yanoname or Waika group, despite the fact that both belong to another linguistic family. It seems likely that the Makú, belonging from a cultural point of view to the same old stratum as the Yanoname (inner marginals), may be of the same racial proto-Australoid stock described by R. Gayre of Gayre in *Ethnological Elements of Africa,* including the Ainu of North Japan.[14]

POSITION AMONG TRIBES OF THE AREA

Dom Pedro Massa[15] calls the Makú the pariah of the woods. The other tribes in the Uaupés area have a hierarchical structure. The Betoya tribes and the Aruakian Tariana are subdivided into many clans or classes with three or four leading clans — an aristocracy at the top with three lower clans which are called "slaves."[16] All these tribes are exogamous.

The Makú, however, are completely different. Racially, culturally and linguistically they are different stock and they are completely separate from the other tribes. A Makú man can only marry a Makú girl, although preferably, but not necessarily, of another group. He may never marry a girl of another tribe and no man from another tribe will marry a Makú girl. The other tribes claim that the Makú are not people at all but "children of the jaguar." Because of this Makú are not allowed to live in the houses of other tribes or build cabins near the houses of other Indians. They are obliged to live outside the villages of the other tribes. If Makú are given food by other Indians for whom they are working they must eat it apart from the other Indians. Makú are completely prohibited from participating in the feasts of other tribes and are not even allowed to attend them simply as observers. The first Salesian missionaries noted that when a Makú received some cloth or a pot as a present, other Indians took the present away from him with the remark that "children of the jaguar" did not need such things. Tukano, Tariana, Dessano and Miriti-Tapuia forced the Makú to work on their plantations

[14] Compare with my "The Aharaibu Indians: A 'White' Tribe in the Amazon," THE MANKIND QUARTERLY, Vol. X, No. 4, April-June 1970, pp. 185-198.

[15] Dom Pedro Massa, *De Tupan a Cristo,* Missoes Salesianas do Amazonas, Rio de Janeiro, 1965, p. 67.

[16] P. Alcinilio Brüzzi Alves da Silva, *op. cit.,* p. 472. The "middle" clans may be considered free commoners.

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and also provide game for them.[17] Should the Makú refuse to carry out these duties they are ill-treated. Other Indians will even force the Makú to hand over their sons to them. These boys are compelled to serve as *pagen* (pages) to the sons of their masters. The chiefs of the Tiquié and Papurí river used, and still use, Makú to provide game and fish and take care of the chiefs' children. However, these Makú are not allowed to live in the houses of their masters and cannot participate in tribal festivals. O Tucano Bibiano Vascoceellos told me: "The Makú are for our service during peace and warriors in time of war." Even as late as the nineteenth century the Tukano sold Makú to white traders and received payment for them. This is proved by a document of 1882 which states that Franciscan missionaries banned the Tukano of the upper Rio Tiquié from selling Makú. However, this does not appear to be a real form of slavery, but rather a relationship more akin to vassalage. Today, in return for their services, the Makú receive protection and sustenance. If the work on which they are engaged is completed they are allowed to return to their *malocas* (common house) and live there freely, with their own chiefs and shamans. Alves da Silva[18] claims that Makú women and girls must serve their masters as concubines during these working periods. This seems to be an exaggeration. Old missionaries, like Dom Joao Marchesi, P. A. Giacone, P. E. Lopez and P. M. Maltan, who have dedicated almost the whole of their lives to the service of these tribes, have told me that there is no proof of this. I myself observed that Makú women are anxious to protect their daughters and the girls never go out alone unless accompanied by their mothers.

In 1960, accompanying the late Bishop Dom José Domitrowitsch, I visited the missions of Jauareté and Pari-Cachoeira. The bishop wanted to take photographs of all the boys and girls of the major groups. All the other tribal groups came forward proudly and gladly but not so the Makú. In Jauareté they appeared only hesitatingly and reluctantly and in Pari-Cachoeira they fled. In the Tukano village of Alta Barreira the catechist, himself a Tukano, pointed to some Makú who were without clothes and observing our arrival from a good distance and said: "Look, there are some natives," forgetting that he was himself a

[17] Father Alfonso Casasnovas, who was appointed missionary to the Makú in 1972, told me in January 1972 that this practice still exists. Makú are still working on plantations for other tribes and Father Casasnovas found Makú boys and even a girl in a Tukano village. In an ethnological map of the Uaupés river and the area of the Tiquié and Papurí rivers, Father Casasnovas shows that each village of the Betoya and Aruakian tribes has its own group of Makú working for it.

[18] P. Alcinilio Brüzzi Alves da Silva, *op. cit.*, p. 386.

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native. In Sao Paulo, on the upper Rio Tiquié, the Tukano ordered some Makú to stand back and were only called upon to appear when Father Maltan insisted that he wished to see them.

On the Rio Negro the Kabari and other small groups of Makú hold a similar position as their relatives in the Uaupés region. The population of Rio Negro consists mainly of *caboclos*, who have resulted from miscegenation between the Aruakian Baré and white settlers, including a few Portuguese merchants and owners of plantations of Para rubber trees (*Hevea brasiliensis*).

Most of the merchants on the Curi-Curiary river in Camondé, Maçarabi, Bom Jardim and Tapuruquara have Makú in their service. The Makú are lodged in miserable cabins without furniture, are very poorly dressed and very shy. If a missionary is known to be on his way to visit the village their masters will order the Makú to disappear. Whereas all parents send their children to the mission boarding schools the merchants refuse to send Makú to learn anything. I once asked some Makú in the village of Bom Jardim why they did not return to their tribe and they replied: "The master does not permit it." In November 1957 we encountered a Makú woman in the house of a merchant near Bom Jardim. When the merchant's wife was asked what the Makú woman was doing there, she said: "My sister has given her to me." The merchants of Tapuruquara visit the Kabari on the upper Uineixi to collect forest products but payment is very low and often nothing at all. The merchants often take away Kabari children, promising to give them an education. The "payment" for these children is three gallons of manioc flour. These children never receive any education but are used by the merchants as servants.

In a sad condition are the Makú of Sao Gabriel. They carry out such duties as hunting and collecting for merchants and are mostly "paid" with alcohol. As a result they live in a grave state of degradation.

Salesian missionaries have made repeated attempts to help the Makú. Dom Joao Marchese and P. E. Lopez have visited their villages, using Makú as guides to take them through the forests, and P. Maltan was guided by Makú through the woods between Pari-Cachoeira and Jauareté. The Makú proved to be very good guides, very attentive and courteous. In an effort to protect them against ill-treatment by other Indians, Dom Joao Marchese called them his "little brothers" and they have remained faithful. An interesting fact has emerged from this. The Tukano have now come to the conclusion that all white men are really like these Makú, and superior to the Tukano and Tariana only by their technical arts, and not their aristocratic equals.

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Boys and girls of the Makú have been accepted by the mission schools, although Indians have protested at this action. For instance, at supper time, when all the children are sitting down, the little Makú took their plates and ran out of the refectory and sat down on the ground to eat their meal with their fingers. Dom José Domitrowitsch and P. J. Schneider accepted children at the mission of Sao Gabriel but they fled after two or three days. The Salesian assistant and sisters could not give a reason. A few children remained for two or three years in the colleges, but Dom Pedro Massa states that the system did not seem successful.[19]

Repeatedly the Makú have asked for a mission which would be open only to their own people but shortage of Salesian missionaries as well as the dispersion of Makú groups throughout the jungle delayed carrying this out.

Attempts were made towards providing one by Dom J. Marchese, P. Luciano and P. L. de Stefano, although the death of Dom Pedro Massa proved to be another setback for this missionary work. An attempt by Dom Marchese was a failure. He wanted to settle some Makú on the Salesian-owned plantation of Fatima on the Tiquié river. The Tukano objected, saying that the region belonged to the Tukano and that Makú would not be allowed to settle there. Recently the Tukano chief of Sao Francisco on the Rio Tiquié asked the mission to found a school solely for Makú children and to send a girl teacher from the pedagogical school of Tapuruquare, promising to provide food for the children.

In conclusion it can be said that the position of the Makú among the tribes of the Uaupés and settlers of the Rio Negro is an authentic case of racial segregation.

OTHER EXAMPLES OF RACIAL SEPARATION AMONG INDIANS

The Makú are not the only case of racial separation among the pre-Columbian population of the New World.

Alain Gheerbrant[20] tells of a similar relationship between the Karibian Maquiritares and the Guaharibos, a branch of the Kamishawani of the Yanoname linguistic family. The Kamishawani play a similar rôle to that of the Makú

The relationship between the Urus of Lake Titicaca and the Uro d'Ancoaqui and the racially, culturally and linguistically

[19] Dom Pedro Massa, *op. cit.*, p. 67.

[20] Alain Gheerbrant, "Im Urwald zwischen Orinoko und Amazonas," *Welt ohne Weisse*, F. A. Brockhaus, Wiesbaden, 1955, p. 211.

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different tribes of the Bolivian and Peruvian highlands must also be called racial separation. Here, too, the Uro have a similar position to that of the Makú.[21]

The most famous example, however, may be that of the Inca Empire. The Inca Ayllus or Hatun-Rincriyoc formed a racially and culturally distinct caste which even had its own language, which was not known to the Hatun-Runa, who were the broad mass of the population of the Inca empire. The Incas had fairer skins, and were even known to have people with blond hair.[22]

In North America, the Athapascan Etchareetine have been called *Awokanak* ("slaves") by their Algonquin neighbours the Cree, and seem to have held a similar position to that of the Makú.[23] A similar position may have been occupied by the Nijora among the Pima, Yuma and Papago of Arizona.[24]

[21] Siegfried Huber, *Im Reiche der Inkas*, Walter Verlag. Olten, Switzerland, 1956, p. 43; A. Métraux, "Contribution à le Ethnographie et à la Linguistique des Indiens Uro d'Ancoaqui," *Journal de la Société des Americanistes*, Vol. XXVII, 1935, p. 59.

The Hatun-Runa was composed of tribes who spoke different languages, often transferred from their original homelands to other regions, and all accepting the Ketshua language. Properly speaking the Incas were a great clan or tribe who dominated all others and did not mix with them. (The last Inca, Atahualpa, was the son of the Inca king and royal princess of the kingdom of Quito. Because of this Atahualpa could not succeed to the Inca throne; the legitimate heir was his half-brother Huaskar. The king decided, however, to divide the kingdom between them, a decision which resulted in war and helped Pizzaro conquer the country.) The Incas maintained their racial integrity by keeping themselves apart from the broad mass of the people; they even had their own language. All high officials (governors, state councillors, and so on) had to be members of the Inca clan Hatun Rincriyos. The only legitimate wife of the king was his own legitimate sister and only her children could be heirs to the throne.

[22] Siegfried Huber, *op. cit.*, pp. 72 and 76.

[23] F. W. Hodge, *Handbook of American Indians, North of Mexico*, Pageant Book Company, New York, 1960, Vol. I, pp. 439-440.

[24] F. W. Hodge, *op. cit.*, Vol. II, p. 78.

CORRIGENDUM

In Vol. XIII, No. 1, on page 20, line 10: for "former" read "latter."

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The Rise and Fall of Nations: Genetic Impoverishment

A Brief Note on the Errors of Lamarckian Thought as a Factor in Creating Genetic Impoverishment, with Particular Reference to the United Kingdom

By R. GAYRE OF GAYRE

In the realm of zoology the operation of genetic factors is acknowledged and understood, but when we come to apply them to man (who is biologically a part of the animal kingdom) we get not merely a resistance to any acceptance of their implication, but an emotionally orientated dogma which, in effect, denies (for all practical purposes) their influence in the affairs of man.

This is due to the fact that a large part of social, political, and even certain psychological thought is based on the concepts of Lamarck who, in the realm of natural science, tried to apply and rationalise the revolutionary thinking which had its development in the French philosophers and economists of the eighteenth century (who were responsible, in fact, for the development of the dogmas on which communism was later to be erected) and whose direct result in their own time was the French Revolution.

In the biological field this led Lamarck to enunciate the doctrine of the inheritance of acquired characters — that is that traits which were inculcated in one generation are transmitted to the next. This doctrine was, and still remains, necessary for all those who espouse communist, marxist and, indeed, all so-called " liberal " views. For these political dogmas rest upon the concept that man can be moulded or " socially engineered " into the form of society necessary to achieve the ideal state which they envisage.

Closely allied to this, and for all practical purposes part of this dogma, is the belief in the inherent goodness of natural man. This stems directly from the ideal of the eighteenth-century philosophers with their concept of the noble savage.

We may say, therefore, that the corpus of ideas which belonged, and still belong, to this school of thought is based on the idea that man, given the opportunity, will be good, and that

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any evil propensities which he shows are due to the bad characteristics which he has acquired. Consequently, to improve mankind it is only necessary to change the environment, social, political and economic, as well as the physical surroundings.

It is obvious that these views are basic to communistic and marxist thinking as well as virtually all radical political thinkers. It accounts for the emphasis upon environmentalism in all of its pronouncements and, furthermore, it accounts for the attempts which are made (abortively) from time to time to try to show even that settlement in new countries changes the type of the migrants to that of the native. In the United States they are familiar with attempts of this kind stemming from certain social anthropologists, and in particular Franz Boas and his school of thought.

From the beginning scientists were sceptical of this reasoning. Weissmann, the German naturalist, said that he had cut off generations of rats tails and yet they were still born with tails. There was the standing example of circumcision among Jews, Moslems and African peoples, and yet males were still born with foreskins. In fact this doctrine never was able to prove itself even in the pregenetic age.

When, however, the Abbot Gregor Mendel discovered the laws of heredity, Lamarckism was given its death blow among all scientists working with living things. Consequently, since the beginning of this century it has been established that the environmentalist dogma of the inheritance of acquired characters is quite untrue. No reputable body of scientists today (not even in communist countries since Lysenko has been discredited) will be prepared to look to the environment to account for the traits, physical, mental or emotional, found in living things. It is to the genetic constitution (the heredity) to which we must turn if we wish to explain the characters of any given population.

Nevertheless, despite the fact that all scientists concerned with biology have ineluctably been forced to accept the implications of genetics, we find that these laws have had little or no effect on a large body (although, fortunately, not all), of sociologists, social anthropologists, political thinkers and philosophers, very many psychiatrists, and practically all politicians, dependent as they are on the mass vote, who still proceed on assumptions which are now nearly two centuries behind the times. What is more, the emotional pressures which they develop for their quite untrue doctrines are so great today in the Scandinavo-Anglo-Saxon countries in particular, that rather than diminishing in numbers they are growing. It is now much more difficult for me to write objectively today than it was when I was a research student in 1934 without attracting a vicious attack.

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The persistence of some quite inconceivable religious doctrines demonstrate the capacity of otherwise rational, and often learned, men to accept almost any irrational proposition under the drive of a "religious" and "missionary" zeal. Therefore, in this age of lack of faith, we should not be surprised to see the diversion of this capacity for self-delusion (even complete with the associated desire to propagate it and persecute those who reject the dogma) to the materialistic concept that man is captain of his own fate, and (by socially engineering the environment) in accordance with the various nostra of communism, marxism, socialism and "liberalism," to mould mankind in whatever is proclaimed to be the desirable direction of development. Even the smear campaign of name calling (Fascist, Nazi, feudal, and so on) in which they indulge against those who repudiate their biological heresies and their ideas, their refusal to enter into rational discussion on the points of difference, and their attempts to block the expression of views contrary to their own, are all reminiscent of some of the discreditable perversions of religious mania and hysteria of former times. There are even attempts today by some otherwise reputable learned bodies to condemn anthropological publications which oppose these sociological theories which are based upon out-dated Lamarckian thought. The parallel here to the religious intolerant book burning of the sixteenth century is very close. Indeed, it is this very emotional hysteria, developing into irrational hatreds, which has characterised the whole of "liberal" thought leading not merely to persecution and repression of free thought, but to massacres on a huge scale from the French Revolution onwards. Because, therefore, we are dealing with a perversion of thought, which is based on emotional dogma, we find that we are dealing with closed minds where the findings of the biological sciences undermine the preconceived dogma. Indeed, we may add, that in many instances attempts are made by taking certain facts out of context to give the impression that science says the very opposite of what it, in reality, clearly demonstrates (the exposition of Klineberg on the Negro-White intelligence tests is an instance of this sort of thing). Where this cannot be done, standards of proof are demanded of the genetic interpretation which are far beyond those asked for in other biological fields, and immeasurably higher than any court of law would demand. When, because of the nature of the case, this is not possible without reducing mankind to the breeding experiments of the stockyard, the environmentalist then proclaims that the obvious has not been proved and proceeds to continue to enunciate his discredited theories as though they were fact.

It is, therefore, not surprising that the decline of nations is

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attributed to environmental causes and not genetic in most modern thinking. Or, putting the matter another way, the result of immigration, emigration, war, taxation and other social forces are not seen at all in their genetic setting.

There is not the space in this short article to go into great detail, but one can at least refer to several events, past and present, which have had, or will have, very far-reaching effects.

The quite inexplicable and spectacular collapse of British power since 1945 is ascribed to many things — the lack of will to rule, affliction of conscience, and so on, all of which are quite unconvincing, but when we looked at this phenomenon genetically we could see it was inevitable. Let us take a few genetic facts to illustrate this.

For centuries war and overseas service had been dysgenic since its adverse effects had fallen disproportionately upon the élite of the nations making up the United Kingdom. This was particularly so from the nineteenth century onwards. One has only to visit Christian cemeteries in India to see the names of whole companies of men and their officers struck down by cholera in the same month to realise that overseas service in the nineteenth century was a bleeding of a nation of its adventurous élite which had to be added to its losses in the Indian mutiny and numerous expeditions and local wars.

These continuous campaigns went on to the South African war, and then came the first Great War with its incalculable losses in manpower, when, for instance, after the battle of Loos, a second lieutenant came out commanding the remnant of a gallant Highland regiment.* When it is realised that Britain (like Spain before her) was wedded to a principle which was a selective recruitment of only the best for slaughter (unlike Germany and France which had efficient conscription systems) then the genetic loss becomes evident. It was not only that a generation was virtually wiped out, but it was selective of the leadership in all classes. The Second World War continued this same trend although on a less stupendous scale.

While these dysgenic events were occurring politicians took a hand in ensuring the extinction of British greatness.

Scotland, which has given more to British greatness out of all proportion to her numbers than any other stock in the United Kingdom, because of neglect since the Treaty of Union with England in 1707 (which was a major disaster for Scotland), has suffered an unprecedented emigration of her population. Despite the fact that Scotland led the Industrial Revolution, these losses

* Now the Rev. H. T. Coles, C.L.J., C.M.L.J., Chaplain of the Order of St Lazarus, Church of St Vincent, Edinburgh.

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reduced her population of good genetic ability and so lowered the overall ability of the United Kingdom. (It might also be mentioned that Scotland has always produced more regiments per head of population than England and so has suffered as a consequence more severely from these wars.)

Then Lloyd George, with his left-wing liberal fervour based upon the mistaken concepts of environmentalism, brought in legislation designed to wipe out the landed classes by means of succession duties. The consequence of this type of action, coupled with a graduated tax system, and super tax, designed to "soak the rich," led to a restricted breeding rate (in order to maintain their standard of living) through birth control of those very classes which were genetically the best endowed and, at the same time, encouraged the emigration of many of them overseas to Kenya, Rhodesia and other countries. Now the flight, under continuing punitive taxation, continues to Rhodesia as well as Switzerland, Spain, Portugal, South Africa, Australia, New Zealand and Canada and, until recently, to Malta as well.

Coincident with actions which produced these dire dysgenic results, of removing by their own voluntary exile of the most successful members of society, Eleanor Rathbone, a well-known Liberal Member of Parliament, brought in an Act for family allowances, as a consequence of which, just at the very time when the middle and upper classes had to restrict their birth rates, the least endowed elements genetically of the population were encouraged to expand theirs. Following this came Lord Beveridge and his welfare state which has, as a consequence, continued and developed this trend still further.

Following on the heels of this desperate genetic state of affairs, at a time when qualified artisans, professional men and upper-class families were emigrating in ever-increasing numbers, the Conservative British Government (most of whose numbers accept implicitly the discredited environmentalist assumptions just as much as do all their political opponents) refused, after the war, to close the door to an ever-increasing Negro settlement until it was too late. Then, under the last Labour Government, further ineffectual attempts were made to grapple with this situation. Large numbers of emigrants from equatorial and tropical lands are still settling in Britain under the Conservative Government at this time (1972).* Thus, as the British emigrate there is a Negroid and Asiatic immigration which now, in the Midlands of England, forms a new helot or labouring class which does the work from

* At the time of publication a further influx, this time 50,000 Asians turned out of Uganda without any condemnation by the United Nations, is taking place and the bulk of them are to be received in Britain.

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which the English labouring classes prefer to escape if they can. The reproduction rate of the West Indians is out of all proportion to that of the native English and so a progressively growing Negro population must emerge. There are some areas of cities such as Bradford, Yorkshire, where there is already an alien racial majority.

No one who knows anything of the fundamental differences of the major racial groups can, in any way, suggest that this exchange of populations is beneficial to Britain. Of course the environmentalist-conditioned politicians and sociologists try to comfort themselves with the myth that all men are the same under the skin and by " education " they can be made similar.

The writer has travelled, lived and worked extensively in Asia and Africa and has had the friendliest relations with the peoples among whom he has moved. But it would be a denial of truth to ignore the overwhelming evidence of differences of physiology, brain structure and intelligence due to genetic factors which exist. Furthermore, whatever the great gifts of other stocks, and they are many, when it comes to those aptitudes necessary for developing the technological civilizations (which are creations of the Caucasoid and Mongoloid stocks) it is not only self-evident, but established beyond any doubt from prehistory, history, intelligence tests, and a host of ancillary studies, that the Negroids are not, generally speaking, as well endowed genetically in this direction as the other stocks from the northern hemisphere. The Negroids have mental attributes in a quite other direction, more associated with the parietal and temporal than the frontal lobes.

Therefore, to have driven out by various pressures white emigrants from the United Kingdom and replaced them by about one million West Indians and others, genetically speaking this can not be said to be a good bargain for Britain if she is to remain in the leadership of the technological states.

The ability of a national group to survive is not only dependent upon intelligence but other traits as well, such as courage. The dysgenic effects of war, over a long period of time, where no counterbalancing factors encouraging the increased reproduction of the warrior class occur, must be, inevitably, to reduce those genes which give rise to courage in the population. It would not be going too far to say that one of the prime factors in the dramatic British recession from Empire since 1945 has not merely been due to a genetic reduction of important élite elements in general but just those which have possessed the ability to rule and the courage to volunteer for war, which have been killed as a consequence of having done so. We know that every possible reason, such as conviction of conscience and similar moral excuses, have been put forward to excuse the flight from imperial

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responsibilities and withdrawal in the post-imperial period from East of Suez and the like; but it is significant that this has occurred only after an accumulation of losses in those elements of the population who were destroyed just because they had the courage to take dangerous decisions, as a consequence of which they went to war and were killed.

Therefore, it seems to me that the flight from responsibility by Britain since 1945 has not only been due to the reduction in the element which was genetically best endowed in the intellectual sense, but also because the moral courage of the élite has also been reduced within the genetic pool of the peoples of the United Kingdom. Every sort of moralising excuse, as has just been indicated, is given to account for this fact of failure to maintain a great rôle as in the past, partly because some are so completely ignorant of the genetic factors involved, and partly because the rest are determined to deny facts inimicable to their philosophical doctrines based upon environmentalism.

It should, in this latter connection, be observed that the Lamarckian doctrine when applied to human society is a comforting one for the mediocre and those of the poorest heredity, who inevitably make up a large part of the masses of any population. Because it teaches that all are inherently equal, and only if they had been given those opportunities in social development, of which they were deprived through force of circumstances alone, they would be as good as the élite, it flatters their conceit. It is an easy doctrine for politicians, publicists, journalists and any others who depend on the support of the masses to preach. For these reasons it is extremely difficult, if not impossible, in such a society as we have in all Western countries, to bring home to the people as a whole the relevance of genetic impoverishment to their own decline from power and ability.

When, therefore, all these factors are taken into consideration, it is clear that Britain's dramatic recession is genetic in origin, as was the collapse of Spain, Portugal, and France after the Napoleonic era, and, indeed, Rome herself. This could be put right by a rigorous eugenic policy, control of migration, and similar factors. Britain could rise again to leadership given the resurgence of a population of high genetic quality. It is hard, however, to see how, in a democracy (as we conceive of it today), this is possible; for in such a state political power has been transferred to the least well-endowed masses who have no realisation of how their own welfare in the end depends on the survival, in adequate numbers, of a genetically well-endowed élite.

As an outside observer it seems to me that the United States is treading the same path as the United Kingdom, but perhaps a

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couple of generations behind.* There is time to learn that the ability of a nation, a clan, or any natural grouping of mankind, is bred and not produced by adherence to theories of political economy and sociology which are based upon scientifically discredited premises of environmentalism.

The recovery of European peoples all over the world will be the nearer achievement in that degree to which they seek to preserve their biological identity and encourage the reproduction of those genes which represent quality.

Miscegenation between widely diverse stocks, if we may judge from history, in itself is a symptom of genetic degeneration and, so far as all stocks are concerned, it is no solution. The evidence suggests it is better that each should seek to preserve its own heredity and uniqueness. Consequently racial mixture is no panacea for the situation in which we find ourselves, if only because it is impossible to create (short of millennia of very exceptional conditions, or the stock breeders' methods) stable hybrids among human beings — for invariably the cross-bred breed back by genetic segregation to the parent racial strains from which they were derived originally. In the end assortative mating ensures the survival of the original stock in its native habitat and the decline, if not the extinction of the intrusive types.

Britain's decline, therefore, can be attributed to a purblind refusal to face genetic facts, and an emotional adherence to the concept of the dogma of environmentalism, which dominates all thinking (certainly south of the Border, for north of it the clan system and a belief in ancestry goes some way to counter this slavish adherence to Lamarckism). It is only by recognising the cause of this disaster, which is one of enormous magnitude when great empires and states collapse, that policy can be directed to recovery. This requires moral courage, and it is seldom, especially under a system of the mass vote, that this is to be found in the leadership of the nations concerned. Peoples in this condition stagger from one ill-contrived device to another, and so from disaster to disaster. A good example is the Wilson Government's reduction of the voting age to 18 years in an electorate

* The Immigration Act of 1965 eliminated once and for all the national origins quota system which favoured immigrants whose fellow countrymen had arrived in America earliest and in the greatest number. Germany, Great Britain, Ireland and northern European countries were the favoured nations under the old quotas.

In the next few years they will be replaced by Italy, Greece, Portugal and a number of Asian countries who were most discriminated against under the old system.

In addition, the American Negro is increasing more rapidly in proportion to the White population, while Puerto Ricans have been settling in the United States in significant numbers.

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which was already woefully ignorant and irresponsible. At least maturity can delay the onset of rash courses of action, whereas immaturity only accelerates wrong decisions and so achieves a more certain decline.

The British greatness was raised on a limited franchise, with the preponderance of power in the hands of the genetically best-endowed classes (the middle and upper), which were reproducing themselves adequately. Their decline has coincided with the passing of power to the masses, which is coincident with the decline of breeding of the upper part of society, while at the same time the welfare state, with its family allowances, places a premium on reproduction of the least well-endowed genetically. It is obvious what is the cause of the dramatic collapses which we have witnessed in our times — a decline due to the acceptance of the false doctrine of Lamarckism.

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Book Reviews

THE FOUR SUNS: RECOLLECTIONS AND REFLECTIONS OF AN ETHNOLOGIST IN MEXICO

By Jacques Soustelle. Andre Deutsch, London, 1971. Pp. 256, 23 figures, 1 map, 22 plates. Price £2.75.

The author deals with the central theme of two Mexican tribes which are the remnants of Mayan and pre-Aztec peoples. The title of the book is taken from the Aztec belief representing four universes which have each ended in disaster, and we are now living in a fifth "sun" cycle. For Soustelle this is a representation of the rise and fall of successive civilisations.

It seems to this reviewer that the author misunderstands the position of Levy-Bruhl's teaching of "prelogisme" (p. 51). He says that no more than a week of living with the Lacandones makes one realise "that in their daily existence they behave with an acute sense of reality about them." Of course they do, or else they would not have survived, nor would any other primitive tribe. But this does not mean they are capable of advanced logical thought, and they can be assimilated to the degree that their faculties can be so developed to equal the averages of other stocks which have advanced earlier and faster in the evolution of their mental processes and conceptions.

It is no argument that these tribes belong to the same linguistic groups as the barbaric, but much more advanced, Maya and similar civilisations. For what happened was the destruction of the élite of the Central and South American civilisations, leaving behind, as survivors, the helot and outcaste groups who never really shared in these civilisations at all. This, in fact, is what the writer himself admits (p. 69).

Soustelle is, of course, right when he draws attention (p. 56) to the fact that a Lacandon will call himself by the Maya *winken*, meaning I am a man, in contradistinction to all other people. All peoples are ethnocentric. This is one of the factors which assists assortative mating, and so preserves tribe, nationality, caste and race.

We have considerable sympathy with the author's aversion to the acculturation to Western civilisation. It not only destroys the tribe, and with it its virtues, but replaces it with a "bastard" type which becomes a hanger-on to the fringes of Western civilisation.

A noteworthy point which is brought out in this book is that the Maya civilisation, although by the time it had only advanced as far as the old world Neolithic, had produced great architecture, mathematics and astronomy, with a notation of figures which included zero (pp. 71-72). Incidentally, the Neolithic civilisations of the Old World, such as typified by Stonehenge, indicate intellectual achievements far beyond the levels for which we have tended to give them credit. (The latest dating evidence is showing that these monuments are much older than formerly believed.)

Soustelle is undoubtedly right in drawing attention to the fact that while technologically backward (for the Meso American civilisations had neither metal nor wheeled vehicles) they were intellectually far advanced, as we have just indicated. This, however, we would consider a difference in the inherent mentality of the Mongoloid-Amerindian mentality, which while being credited with some discoveries of a technical nature (such as gunpowder by the Chinese) tends to be less inventive than the Caucasoids, but at the same time is probably more advanced in many aspects of philosophy, metaphysics, and even mathematics and astronomy, at least,

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if not in time, according to the technological age (Neolithic, Bronze, Iron, etc.) to which they belong.

Judging by the illustrations, there is a vast difference between the very primitive Lacandon he describes and the Otomi and Mazahua Indians. The Otomi, in particular, not only show a much more advanced civilisation, probably by acculturation to Mexican civilisation, but they also indicate by their traits that they are of mixed Caucasoid origin.

It seems to us that the reason why the intellectual, cultural and spiritual heritage of the ancient Central American civilisations have shown no signs of revival is not only because the present-day Indian of Mexico is descended from the peasantry who survived when the Spanish conquerors destroyed their lords and masters, but because the latter were an actual caste. Either they were conquerors of a more indigenous people or they were a caste created by genetic segregation. In either case, what was left behind was a mass of helots deficient of genes of high ability. Had things been otherwise some of the earlier civilisation with its culture and learning would have survived. It was the almost complete extermination of the bearers of genes of superior ability which was responsible for the complete loss of all the past had created.

Soustelle, in speaking of Hellenism, points to Greek borrowings of religious elements from other people, citing among these the fact that the story of Zeus, as Hesiod tells it in the eighth century B.C., can be found in Hittite texts of the second millennium B.C. (p. 161). However, this may not be a case of borrowing at all, as the rulers of the Hittites were of Aryan origin, as were many of their god-names. The story of Zeus, more probably, came from an original Indo-European source common to both civilisations.

This is a profound, but readily readable, thought-provoking book.

R. GAYRE OF GAYRE

THE DEVELOPMENT OF THE BRAIN AND THE EVOLUTION OF LANGUAGE

By Norman Geschwind. Monograph Series on Languages and Linguistics, No. 17. Report of the 15th Annual R.T.M. on Linguistic and Language Studies (edited by C. I. J. M. Stuart). April 1964.

In this monograph Dr Geschwind attempts to specify the evolutionary changes in the design of the brain which are associated with the development of human language. In particular, he relates a linguistic theory of object-naming and color-naming to the anatomical aspects of language.

The author begins with a review of the comparative neuro-anatomy of man and some of the other primates. He distinguishes between the "limbic system," which mediates both the unborn "motor sequences involved in fear, rage and sexual activities" and the subjective sensory experiences related to these activities, and the "non-limbic" portions of the surface of the brain. The latter "make up the bulk of the exposed surface of the hemispheres in the primates, including man." They comprise the classic motor cortex, the sensory regions (i.e., the visual cortex, the auditory cortex and the somesthetic cortex), and the association cortex.

As we ascend the phylogenetic scale the sensory and motor regions of the cortex "become increasingly separated by new areas of cortex," termed "association cortex." This association cortex "occupies a greater percentage of the surface in the primates and achieves its greatest extent in man where it clearly occupies most of the surface of the

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hemispheres." Using as a criterion for maturation the degree of myelination of the nerve fibers, the association cortex is also found to mature later in the life of the individual. Dr Geschwind notes that the development of this association cortex "is responsible for the higher functions of the nervous system."

In both man and the higher primates there are no significant direct interconnections between the limbic regions, the motor cortex and the sensory cortex. Each of the regions "has a significant number of connections only to the immediately adjacent association cortex." The association cortex, however, "may have long connections to other regions."

Dr Geschwind compares the connections between the different regions of the brain in monkey and in man. He finds that in the monkey the major cortical connections from the sensory zones are to the limbic system by way of the adjacent association cortex and the association cortex on the lateral and basal surfaces of the temporal lobe. Dr Geschwind contends that learning in these animals "should consist mostly of associations of non-limbic to limbic stimuli." Thus, the monkey brain is viewed as probably containing visual, auditory and somesthetic regions which, "operating on the whole independently, feed into the limbic system stimuli which are used only to the extent that they more or less immediately affect survival."

Dr Geschwind advances the hypothesis that "man develops language because he can form associations between two non-limbic stimuli." Object-naming and color-naming, for example, are regarded as depending upon the "ability to form non-limbic cross-modal associations, particularly visual-auditory and tactile-auditory." In contrast, none of the main connections in the brain of the monkey is designed to mediate visual-auditory associations. Hence, "the monkey does not appear to have a sufficient basis anatomically to form extensive non-limbic intermodal associations." That is, the monkey "lacks adequate 'memory space' and 'channel capacity' for this type of association."

The author concludes that this greatly increased ability by man to form non-limbic intermodal associations and thus to develop language is correlated with the "marked development of the human brain in comparison to that of even the highest apes." According to the author "the great increase in the size of man's brain is primarily in the association areas, rather than in the primary receptive areas." This growth is reflected in "the frontal pole, the temporal lobe, and in the inferior parietal region," with the greatest relative growth of the human brain occurring in the last-named region. Furthermore, the inferior parietal region (i.e., the region of the angular gyrus) is one of the last regions of the brain to myelinate.

Dr Geschwind observes that the inferior parietal region is placed "between the association cortexes of the three non-limbic modalities: vision, audition and somesthesis." This region is well suited to provide the basis for the formation of non-limbic associations and thus to provide "the anatomical basis for language — or at least for object-naming." The author concludes the monograph with a discussion of the effects of lesions in this area of the brain on human language behavior. For example, "very large lesions of the angular gyrus region produce an aphasic picture in which the patient speaks volubly but communicates little information." In this case, the patient speaks freely since the auditory association area and the motor speech region and their connections are intact. However, the comprehension of language is seriously impaired "since the arousal of associations in other modalities by the auditory speech patterns is also cut off by the lesion."

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The author, who is James Jackson Putman Professor of Neurology at the Harvard Medical School and director of the neurological unit of the Boston City Hospital, is well qualified to deal with the subject matter. For the past several years he has investigated the relations between speech disorders (aphasias) and specific types of brain damage in order to construct a model of the organization of language areas of the brain. Some of this research is summarized in his recent article, "Language and the Brain" (*Scientific American,* Vol. 226, No. 4, April 1972, pp. 76-83). All in all, Dr Geschwind has contributed a useful analysis of the problem of the origin and evolution of human language and its neuro-anatomical basis.

DONALD A. SWAN

THE I.Q. ARGUMENT

By H. J. Eysenck. The Library Press. Freeport, New York, 1971. Pp. 156, 15 figures and tables. Price $5.95.

Professor Eysenck is professor of psychology at London University and director of the Institute of Psychiatry, Maudsley Hospital. He is, therefore, an expert on his subject. This has not protected him, or others for that matter, who in our time have dared to face objectively the facts of the differences in average mental qualities between one major racial stock and another. This is a point of view which the writer of this review has held, and proclaimed, as well as many learned writers in THE MANKIND QUARTERLY. One is only to be met, not by reasoned and reasonable argument, but by abuse, or a demand for proof which is unreasonable outside the exact sciences.

Professor Eysenck enquires into why the American Negro scores consistently lower on intelligence tests, and whether the causes are genetic or environmental in origin.

The writer quite rightly says that there is a quiet "reign of terror" against those who believe the reason is genetic. There is ample evidence of this. The attacks on this reviewer after giving evidence at the Lewes Assizes for showing that the differences were largely genetic is a case which supports this.

Usually the cry of "Nazi" is raised against those who point to the differences as hereditary, but this will not hold water where Professor Eysenck is concerned, as he was an anti-Nazi refugee.

Professor Eysenck traverses the alleged Jensenist heresy, what is race, what is intelligence, that of the American Negro, changing human nature, and the social responsibility of science.

What is important, as Professor Porteus and others have shown and which this author illustrates (pp. 48 ff), is that there are tests which are largely culture-free. Therefore, I.Q. tests are of value and cannot be just brushed aside even if the Negroes come out of them worse than other stocks. Again, we cannot ignore the I.Q. differences between classes. To suggest that these are solely due to environmental conditions is untrue to all the facts and probabilities.

The regression to the mean I.Q. alone would seem to disprove the environmentalist case. That is the children of the lowest social classes come nearer to the mean for the population as a whole, and so higher, just as the children of the higher fall below those of classes of their parents. If environment was the principal fact, or was involved, these children would have been influenced in the same direction as that towards which their fathers tended. The author shows (p. 121) that on culture-fair tests the Mexican American scores higher.

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This is a book written with moderation and without fanaticism. It is an addition to our stock of evidence that proves that the ability of many ethnic and other subdivisions of mankind are affected by heredity rather than environment.

R. GAYRE OF GAYRE

A VICTORIAN SON: AN AUTOBIOGRAPHY

By Stuart Cloete. Collins, London, 1972. Pp. 319. Price £2.25.

This brilliantly written book is the first volume of the autobiography of Stuart Cloete, South Africa's most distinguished novelist. Born in Paris in 1897, Cloete spent his childhood and youth between France and England. Volunteering for the First World War, he became one of Britain's youngest combat commanders. Twice wounded in action, the second time almost mortally, he recuperated from the psychic trauma of war with his young wife in a Normandy village.

A Victorian Son has as its dominant theme the contrast between life in the first decades of this century with its strong individualism, with man's close relationship to the world of nature and with its cruelty and harsh contrasts between opulence and squalid misery, and the homogenized mechanized world of today.

"People sang lullabies to children when I was a baby," Cloete writes, "but everyone sang then. The servants sang when they cleaned the windows or did the laundry; house-painters sang on their ladders. . . . They had eaten no de-natured foods. They had no DDT in their livers, no strontium-90 in their bones."

Sharp class gradations, a consciousness of duty, and a refusal to accept failure, inculcated early in the young, produced individualists of an eminence and mental and moral power that is seldom replicated in this age of collective work and anonymous achievement.

"The hero is out today," Cloete writes. "In books and plays we find a new cult — that of the non-hero, of the drug addict, the alcoholic, the criminal. This is the day of the failure. He fails because he is underprivileged, comes from a broken home, or is a Negro. His excuses are endless — his parents, his teachers, society in general. The only person he never blames is himself. It is the *reductio ad absurdum* of democracy."

American reviewers of Cloete's First World War novel, *How Young They Died,* found its hero's pride in country and soldiering incomprehensible. They could not understand why a young man should hazard his life to protect a nation that was "beautiful, orderly and powerful," imbued with the tradition of glory and governed by men who had not lost the will to rule.

"But if I were a young man today," Cloete concedes, "I cannot imagine myself fighting for England or the Commonwealth. . . ."

> The Magna Carta; the first successful parliament after Iceland; the first successful revolt that ended in the execution of a King; the forced abdication of another; the first socialist government: these are major political achievements. Even the American Republic — though most Americans would deny it — the greatest political success the world has yet seen, was designed and executed by English rebels. But to me the present situation of government by the blackmail of the masses — Labour, students, coloured immigrants — must end in disaster. It took a thousand years to create the English people, possibly the finest relatively homogeneous race yet to be formed. What madness therefore to dilute these x genes with those of

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people of alien tropic origin. Nor do I believe that the present components of the English population could withstand the hardships suffered in the Second World War.

Mr Enoch Powell's popularity seems to prove that I am not alone in this opinion. *I do not believe that all men and all races are equal in ability, there is nothing in history to suggest that this is true* [my emphasis] though it is the popularly accepted theory, and history is being falsified in an effort to prove this thesis.

These views make me in modern parlance a racist. But racism and patriotism must be and are to a great extent synonymous. A patriot is a man who loves and serves his King, country and people. There can be no abstract patriotism. The Kenyans and people of Uganda are racist when they throw out the Asiatics. The Zanzibari were racist when they killed the Arabs and Indians on the island. . . . Racism in fact exists wherever two races find themselves in competition.

Racism appears to be a built-in characteristic of the human race and the complete integration hoped for by the social scientists of today a wishful dream rooted in unreality.

This first volume of Stuart Cloete's autobiography is not merely a record of sensations, emotions and events, though these are recorded superbly and in precise detail, but the re-evocation of an age dedicated to achievement, excellence and freedom.

NATHANIEL WEYL

THE CULTURAL CONTEXT OF LEARNING AND THINKING: AN EXPLORATION IN EXPERIMENTAL ANTHROPOLOGY

By Michael Cole, John Gay, Joseph A. Glick and Donald W. Sharp. Methuen, London, 1972. Pp. 304, 12 illustrations. Price £3.50.

This book uses as its basis of study the Kpelle people in the Republic of Liberia, in West Africa.

The book sets out to be a cross-cultural study claiming to combine anthropological, linguistic and experimental psychological techniques. In point of fact, since it ignores the whole question of heredity and the effect of ethno-genetics on the cultures, thinking and learning of these people, its conclusions can by no means be accepted as objective, as the authors' interpretation of anthropology is social anthropology.

Only at page 6 is race mentioned at all, and that is in the context of Boas's attack upon the concept that differences of a cultural and belief nature are "evidence of fundamental differences in thought processes." It attacks the views of Herbert Spencer, E. B. Tyler and L. H. Morgan for holding to the argument bolstered by the biological theories of Darwin and Huxley, which assumed that the evolution of intellect can be inferred from the assumed evolution of culture (p. 4).

It draws attention to the fact that Boas's major target was the French sociologist Lucren Levy-Bruhl, who "held that every culture is characterised by a set of general beliefs which he called 'collective representations'." They consider it unfortunate that Levy-Bruhl coined the term *prelogical* to characterise rules by which basic ideas are combined. "In addition, Levy-Bruhl assumed, contrary to Boas, that primitivity of material and religious culture is sufficient evidence to prove the existence of primitive mental processes" (p. 6).

With such an "anthropological" basis to the book, and with an assault upon such great thinkers as Huxley, Tyler, Morgan, and Herbert Spencer, not to mention, from the sociological side, Levy-Bruhl, it can

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be appreciated that the anthropological foundations of this book are not merely weak but completely misconceived. What follows from such premises cannot hope to arrive at conclusions which are scientifically reliable — although there is little doubt they may very well be acceptable to much current thinking which excludes, and in some cases brutally, any consideration that there is overwhelming evidence to show that in intelligent living things intelligence and emotional aptitudes are dominated by biologically derived criteria, which plays a large part in the development of society and its culture.

R. GAYRE OF GAYRE

MÄNNISKANS UTVECKLING I LJUSET AV HEREDITET OCH TRADITION, SELEKTION OCH MILJO (The Evolution of Man in the Light of Heredity and Tradition, Selection and Environment)

By Folke Henschen. Furnus Publishers, Stockholm, Sweden, 1971. Pp. 230.

The renowned Swedish pathologist, medical historian and medical geographer — Professor Folke Henschen — has prepared for a wide circle of readers a general work on anthropology with discussions of contemporary problems. The book, which is written by a biologist, is a decided advance over the last book on anthropology by a Swedish medical doctor — namely, Backman's *Människoraserna*. . . . This is especially so in regard to the inclusiveness and universality of Dr Henschen's work. However, the book is not so advanced in the visual aspects. The illustrations of race types are insufficient, being few in number and often poorly selected. This can be attributed to the somewhat varying purposes of the volume. The race names are in part antiquated (e.g., "Caucasid or Indo-Europid race").

The pygmy or dwarf peoples (*Zwergvoelker*) are, according to the author, ancient forms. The entire dwarfing question is barely touched upon. The Polynesians and their great culture are scarcely treated, while the Hottentots are hardly differentiated from the other Khoisan peoples. On the other hand, the discussions of political race questions, including the Negro question, are clear and calm, wise and objective. In the comprehensive bibliography one misses some significant works, such as Curt Stern's *Human Genetics,* Friedrich Keiter's *Rasse und Kultur* (three volumes) and the excellent third edition of Nordenstreng's *Europas Människoraser*. The style is clear and elegant, the contents in general very good. As is often the case of books by non-specialists in the field, the impression is thus somewhat mixed. Next to intelligently written, modern, well-presented parts are to be found out-of-date and inadequate sections. Nevertheless, the book is imbued with a manly and courageous scientific spirit and a striving for truth and justice.

BERTIL LUNDMAN

GAMES, SPORT AND POWER

Edited by Gregory P. Stone. Transaction Books, New Brunswick, New Jersey, 1972. Pp. 230. Price: $2.95 (paperback), $6.50 (cloth-bound).

This is a reprint of essays from the *Transaction* magazine. The subject matter concerns social changes and policies that have aroused needs and anxieties in the organisation of the style of life of various segments of society. The subjects include, among others, magic in professional baseball, classical music and the status game, the dance studio, and the private lives of public museums.

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Journals Received

ETHNOLOGY

A quarterly journal of cultural and social anthropology. University of Pittsburgh, Pennsylvania 15213. Vol. XI, No. 2.

MATERIALY I PRACE ANTHROPOLOGICZNE

Published by Zaklad Antropologii Polskiej Akademii Nauk, Wroclaw, Breslaw, No. 82, 1971.

INTERNATIONAL MIGRATION REVIEW

Published quarterly by the Center for Migration Studies, New York; the Research and Information Division, Department of Immigration, Washington; and the Centro Studi Emigrazione, Rome. Vol. 5, No. 4, and Vol. 6, No. 1.

POPULATION

Review published by L'Institut National d'Etudes Démographiques, Paris. Vol. 27, Nos. 2 and 3.

ACTA BIOLOGICA

Published by Act Universitatis Szegediensis, Szeged, Hungary. Vol. XVII, Nos. 1-4, 1971.

ANTHROPOLOGIE

Published by Moravske Museum, Ustav Anthropos, Brno, Czechoslovakia. Vol. IX, Nos. 2 and 3, 1971.

REVISTA DE ESTUDIOS POLITICOS

Published quarterly by the Instituto de Estudios Politicos, Plaza de la Marina, Espanola 8, Madrid. Nos. 181 and 182, 1972.

JOURNAL OF BIOSOCIAL SCIENCE

Quarterly journal published by Galton Foundation by Blackwell Publications, Oxford, England. Vol. 4, Nos. 2 and 3, 1972.

RACE

Quarterly journal of the Institute of Race Relations, London. Vol. XIII, No. 4, and Vol. XIV, No. 1, 1972.

TERZO MONDO

Published by the Centro Studi Terzo Mondo, Milan.
Vol. V, No. 4, 1972.

SOUTH AFRICA INTERNATIONAL

Quarterly published by the South Africa Foundation, Johannesburg. Vol. II, No. 4, April 1972.

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by R. B. Prosser

Published: Birmingham, 1881, Journal Printing Works. Originally published in an edition of only 50 copies, this is probably the rarest book on Birmingham. The new work includes an introduction by Professor Asa Briggs, Vice-Chancellor of Sussex University.

pp. 264. **£2.50**

Place Names of Scotland

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